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PREFACE.

THE introduction to our readers of the first part of Volume V of the *Agricultural Gazette* would appear to be a convenient opportunity for a brief retrospective glance at the work of last year, and a hint of the possibilities of 1894.

There is one point upon which it is fair to express sincere gratification, and that is the continued and increased appreciation of readers both at home and abroad in the efforts of contributors to the *Gazette* to benefit agriculture in all its branches. It must not be forgotten that the whole of these contributions are made *con amore*, and the Government has never been called upon for a single shilling by way of remuneration to those who, month after month, assist in sustaining the reputation of this now well-established work. With regard to the year just completed—and particularly the latter half of it—the staff of the Department was diminished one-half. At the same time, in spite of the transfer of the crop-reporting to the office of the Government Statistician, the actual work performed by officers has steadily and perceptibly increased. While showing that our agriculturists appreciate our efforts to render their calling more remunerative, it will be apparent that an increase in inquiries for information must of necessity make very large calls on the energies of the reduced staff, so that their time for the work of article-writing is practically confined to the hours which are euphoniously termed "spare time."

Among the new departures which were initiated during the year 1893 may be mentioned the exhaustive inquiries which were conducted by Dr. Cobb regarding the diseases affecting sugar-cane on the Northern rivers, and the no less exhaustive experiments which are still proceeding at Moss Vale with a view to mitigating the effects of worms in sheep; and in this branch of inquiry (the Pathological) it should be added that the investigations regarding rust in wheat made considerable progress during the year. None of these matters are such as can be settled off-hand, but it is satisfactory to be able to report undoubted progress. There are two other branches of agriculture as to which a distinct advance has been effected. Experiments were commenced, and are still proceeding, with a large number of varieties of tobacco, with the object of ascertaining those most suitable of the most marketable varieties for each of our tobacco-growing districts. These experiments were willingly undertaken by experienced men, and the results will be fully recorded during the present year. A definite, and, it is believed, wise step has been taken in connection with our wine trade, full particulars of which are given in the present issue. There is no doubt that even a limited progress in the direction decided upon must have the effect of opening up the London market to wines which have only to be properly known in order to secure a lasting appreciation by European wine-drinkers. The fruit trade also received a full share of attention, and the efforts of the Pomological Committee are being directed to promoting the cultivation of such fruit as will command the foreign market, and render this neglected industry the remunerative one which it has become in other parts of the world. Given good varieties, careful handling, and tasteful and intelligent packing, and New South Wales will rapidly attain the eminence to which her soil and climatic conditions entitle her. While on this subject, it is

worthy of note that the result of the cold-storage experiments conducted by the Department has cleared the way for a more satisfactory result of exporting to distant markets. Another important industry, that of Sericulture, has also received practical attention. A large quantity of valuable graine, or eggs, has been received as a present from Italy, and the Department has obtained permission from the manager of the A. A. Company to utilise their mulberry plantation at Booral for the purpose of cultivating and feeding the worms, and imparting instruction in all branches of the industry.

The work at the Agricultural College at Richmond will doubtless be rendered more effective when the new dairy and other buildings now being erected are completed, and in the meantime the number of students continues to increase, while the results of the examination prove conclusively the completeness of the training imparted. This work of education will receive considerable impetus and assistance by the establishment of experimental farms at Wagga and on the Richmond River, to which it is proposed to draft such students as may desire to gain practical and scientific training in fruit and vine growing at the former, and a knowledge of semi-tropical farming at the latter centre.

In reporting progress, as it appears from the Departmental point of view, it is satisfactory to note the progress of the past year, as shown by the increased area of land under cultivation. Without claiming any unreasonable credit for assisting in promoting this increase, the Department may be permitted to offer its congratulations to our pioneers, and to assure them of cordial co-operation in the future as in the past.

Useful Australian Plants.

By J. H. MAIDEN,
Consulting Botanist.

No. 5.—The Black Bean or Moreton Bay Chestnut.

(*Castanospermum australe*, A. Cunn.)

Aboriginal Names.—"Irtalie" of the aboriginals of the Richmond and Clarence Rivers, New South Wales (C. Moore). "Bogum" was an aboriginal name in the northern parts of the same Colony; "Kongo" of the natives of the Russell River, Queensland (F. M. Bailey).

Vernacular Names.—Because of the seeds, which are very large beans, this tree goes under the name of bean-tree; and because of the dark colour of the wood, and partly by way of distinction from the red bean (*Dysoxylon Muelleri*), it is usually known by timber merchants as black bean. Moreton Bay Chestnut is an old name for the tree, because it was first found in the Moreton Bay district.

Botanical Name.—Castanospermum, from the Latin *castanea*, a chestnut, the sweet chestnut, and *spermum*, a seed. The tree is confined to Australia, and in non-Australian descriptions of it the name is usually explained on the ground that "the seeds are roasted like chestnuts." This matter is alluded to later on. It belongs to the natural order *Leguminosæ*.

Flowers.—They are borne on the last year's wood, bear a general resemblance to pea-flowers, though more solid and fleshy, and in colour vary from yellow, through all stages of orange, to coral red. They are very handsome, though not available for cut flowers.

Fruit.—The seeds strongly resemble the horse-chestnut of Europe, but they are usually much larger in size; and they are found in a very thick pod, almost circular in section, like a distended broad bean.

The Bean-tree as furnishing food for man.—This tree was discovered by Mr. Charles Fraser, colonial botanist, and Mr. Allan Cunningham, a botanist then attached to the Royal Gardens at Kew, and who afterwards succeeded Mr. Fraser at Sydney. The plant is figured and described in Hooker's *Botanical Miscellany*, vol. i (1830), which contains an account of a botanical trip made by these gentlemen in the neighbourhood of Moreton Bay. A forest "near Brisbane Town," contains "a most interesting new plant producing fruit larger than a Spanish chestnut, by which name it is here known. . . . By the natives the fruit is eaten on all occasions. It has, when roasted, the flavour of a Spanish chestnut, and I have been assured by Europeans who have subsisted on it exclusively for two days, that no other unpleasant effect was the result than a slight pain in the bowels, and that only when it is eaten raw." Sir William Hooker adds a note: "Although the large and handsome seeds are eaten by the natives of Brisbane River, and by the convicts in that part of our Colony, as substitutes for our Spanish

chestnuts, I have found them hard, bitter, and their flavour not unlike that of the acorn." Extended experience shows that very few stomachs can tolerate them. Dr. T. L. Bancroft, of Brisbane, has examined the beans, and is very emphatic in regard to their deleterious properties as far as man is concerned. He states that if a small piece of the bean be eaten it causes severe diarrhœa, with intense griping, and he states that it does this whether it has been previously soaked in water or even roasted. He states that no poisonous principle is removed by water, and no part of the plant is bitter. Mr. Charles Moore, Director of the Sydney Botanic Gardens, exhibited a sample of starch or flour of the beans at the Intercolonial Exhibition of Melbourne, 1866, and he supplied the following information concerning his exhibit: "The beans are used as food by the aborigines, who prepare them by first steeping them in water from eight to ten days. They are then taken out, dried in the sun, roasted upon hot stones, and pounded into a coarse meal, in which state they may be kept for an indefinite period. When required for use the meal is simply mixed with water, made into a thin cake, and baked in the usual manner. In taste, cakes prepared in this way resemble a coarse ship biscuit." Usually the aborigines scrape it, by means of jagged mussel shells, into a vermicelli-like substance, prior to soaking it in water. The starch or flour is neither better nor worse than many of the food starches at present consumed for food. As an experiment, a chemist at Lismore once made 40lb. of starch from the beans, which he sold at 4d. per lb. Opossums are fond of the beans.

The Bean-tree as a Plant Injurious to Stock.—Stock-owners have long waged war against this tree, owing to the belief that cattle and horses are poisoned through eating the seeds. They are not, however, a poison in the strict sense of the term, since no alkaloid or poisonous principle can be found in them. They have frequently been examined by chemists, and Mr. W. M. Hamlet, Government Analyst, has reported on the subject to this Department with negative results. (*Annual Report of Department of Mines*, N.S.W., 1886 p. 46). All the same, the beans kill the stock, owing to their highly indigestible character, the indigestible portion in time forming a ball in the stomach. The leaves also are found to be injurious, and animals which take to eating them become very fond of them, and when taken away return long distances to these trees, and according to some accounts become affected similarly to animals which eat the Darling Pea, and, if not carefully looked after, they will pine away and die. Following are some interesting notes in regard to bean poisoning on the Richmond River:—"1883 was a dry season, and grass scarce. —— informed me that he had lost over 100 head of cattle by bean poisoning. Next day my attention was drawn to a few cattle in the stockyard said to be poisoned by eating beans. I inquired of the stockman if he had any proof that they had eaten beans, when he pointed to a beast that had died the day before, and beans had been taken from its stomach. In reply to my questions he said he expected some of the cattle in the yard to recover. They appeared much purged, discharging thin, watery, fœcal matter. Cattle seem to be attracted by the bright green appearance of the beans as they lie upon the ground. Many cattle and horses on the Richmond have been lost from bean poisoning. —— lost a valuable entire horse and cattle in this way; and many others have similar experience. It appears to affect horses in a different way to cattle. —— informed me that while removing horses from a paddock in which the bean-tree was growing two of them died without previously showing any symptoms of poisoning." The seeds are also rapidly fatal to pigs in some cases, probably when devoured on an empty stomach.

Leaves.—Pinnate, as shown in the drawing, and in a mass, of more than ordinarily handsome appearance. The foliage is dark and the whole tree shapely, quite justifying Cunningham's laudatory remarks in regard to it. Those who are not familiar with the tree in its native habitat may see some magnificent specimens in the Sydney Botanic Gardens.

Exudation.—A gum from this tree was shown in the New South Wales Court at the Paris Exhibition, 1867, but I cannot find any account of it, and it does not appear to have been examined. The bark of this tree is often glazed in patches with a gummy exudation, but I have not been able to get a quantity approximately pure. It is not likely to have commercial value, as it does not appear to be soluble, but the samples seen may have been those from which the soluble portion had been washed away by the rain, leaving the insoluble or metarabic portion. It would be desirable to investigate the gum from a scientific point of view, and doubtless some North Coast residents can favour the Department with specimens of it.

Bark.—Smooth, dirty grey externally, pale brown or yellowish internally. A tree 2 feet in diameter has a bark (say) ½-inch thick. It is not astringent, and therefore not to be thought of by the tanner. It is, however, bitter to the taste, and probably contains saponin, though I have not chemically examined it.

Timber.—This timber is easiest described by stating that it strongly resembles walnut. I have always endeavoured to urge moderation in advocating the claims of colonial timbers, feeling sure that our timbers have received a good deal of harm from indiscriminate praise; but, having kept Black Bean under observation for a number of years, and having caused large quantities of it to be worked up into various articles, I think very highly of it. I look upon it as scarcely inferior to walnut. People sometimes complain of it that it warps and splits a little, but it does not do this if it receives the seasoning that cabinet woods receive in the northern hemisphere. Let Black Bean be felled when the sap is down, and given a reasonable amount of seasoning, and I do not hesitate to say that it may be pitted against walnut without disgrace. Black Bean is easier to dress than even cedar; in fact it is almost perfection as regards the ease with which a surface can be got on it. It polishes readily, but the grain is inclined to rise under polish. This timber often shows a beautiful figure; planks which have the figure in bands, like the marking of an agate, are really gorgeous. Mr. Allen Ransome tested some specimens sent to the Colonial and Indian Exhibition. He thus reports:—"A beautifully figured, brown wood. The sample sent, being very wet, was tried under somewhat unfavourable circumstances. A baluster was turned from it, and some boards and panels planed, the work from both lathe and planing-machine being excellent. The wood should prove valuable for cabinet-makers, but should be thoroughly seasoned before being used, as it shrinks very much in drying." I have already alluded to seasoning in connection with this timber, but Mr. Ransome's specimen, "being very wet," is hardly a fair one from which to draw conclusions. In the building of the Austral Banking Company, in Phillip-street, I have seen Black Bean used for framing twelve months after felling, and it was standing splendidly two years afterwards. A piece of Black Bean, bone dry, having been seasoned over twenty-five years, has a weight which corresponds to 39 lb. 8 oz. per cubic foot; but, as a rule, the timber is heavier than this. Although the great use and value of this timber is for cabinet-work, yet it has been used for rougher work. I am informed that on the Tweed River it has been used for culverts, and when free from sap it lasts well under ground. Mr. Forester Pope, of

Murwillumbah, also reports:—"Very durable; will last any number of years under the ground." This is the more satisfactory, as for many years it was not considered to be a durable timber. It is also used for staves. The sap-wood is white and thick, and of all the hundreds of New South Wales timbers with which I am acquainted, I know of no other sap-wood so readily attacked and so promptly destroyed by borers as this one. Insects speedily reduce it to a flour-like substance.

Size.—A fair average height would be 60 or 70 feet, with a trunk diameter of 2 or 3 feet. At the same time it frequently attains a height of nearly double this, with a diameter of 5 or 6 feet.

Distribution.—It is usually found growing in brush land of the very richest soil, usually near the banks of rivers in the Clarence, Richmond, and Tweed River districts, but frequently in the scrub, a considerable distance from creeks and rivers. It comes as far south as the well-known Don Dorrigo Forest Reserve, in the Bellinger River District. It is also found in Queensland, extending a considerable distance along the coast districts.

Propagation.—From seed (the large "beans"). The tree can be supplied by every nurseryman.

Reference to plate (Bean tree).—A, flowering twig; B, flower, two-thirds natural size; C, standard, two-thirds natural size; D, wings and keel plates, two-thirds natural size; E, calyx, two-thirds natural size; F, stamens and pistil, two-thirds natural size; G, pistil, two-thirds natural size; H, pod or bean, about one-fifth natural size; J, seed, about two-thirds natural size; K, sketch of a tree in the Sydney Botanical Gardens.

Castanospermum australe, A. Cunn.

"Bean Tree" or "Moreton Bay Chestnut."

Two Fodder Plants interesting to the Wool-grower.

By J. H. MAIDEN,
Consulting Botanist.

When we are reminded that the botanical name of lucerne is *Medicago sativa*, it will be at once conceded that agriculturists in New South Wales owe a good deal to the genus *Medicago*. It contains about forty species, and many of them are useful fodder plants. None of them are Australian, but a number of them have been introduced, some purposely, and some by accident. The name *Medicago* is said to be derived from *Medike*, a name given by the Greek Dioscorides to a grass from Media. The common English name for these plants is Medick of one sort or another. Thus, the lucerne is sometimes known as Purple Medick, those which have burr-fruits as Burr-Medicks, and so on. Those which have smooth, hookless, burrless fruits or pods, like the two species now depicted, should be given every encouragement to spread.

A few months ago Mr. C. H. Fitzhardinge, of Dubbo, sent *Medicago orbicularis* to the Department for naming, and pointed out that the fruits were without hooks to attach themselves to wool. At about the same time the following passage was contained in the *Agricultural Journal*, the official organ of the Department of Agriculture of Cape Colony. (Issue of 7th September, 1893):—"I send you seeds of two more fodder plants, *Medicago scutellata* (Bauh.) and *M. orbicularis* (All.). You, doubtless, have a careful man to start them. They are annual, but produce an immense number of fruits, which the sheep lick up and eat when pasturage fails. I have gathered as many as 1,400 seeds from a single plant." This is by Baron von Mueller, to whom, therefore, belongs the credit of widely publishing the advantages of a burrless Medick, and he has been the means of distributing both plants in many Australian localities in which it now flourishes.

Figures are now given of two species of burrless Medicks, and, as the botanical descriptions of them are not readily available to most people who have English text books (as they are not natives of Great Britain, but come from countries bordering on the Mediterranean), I give the descriptions herewith.

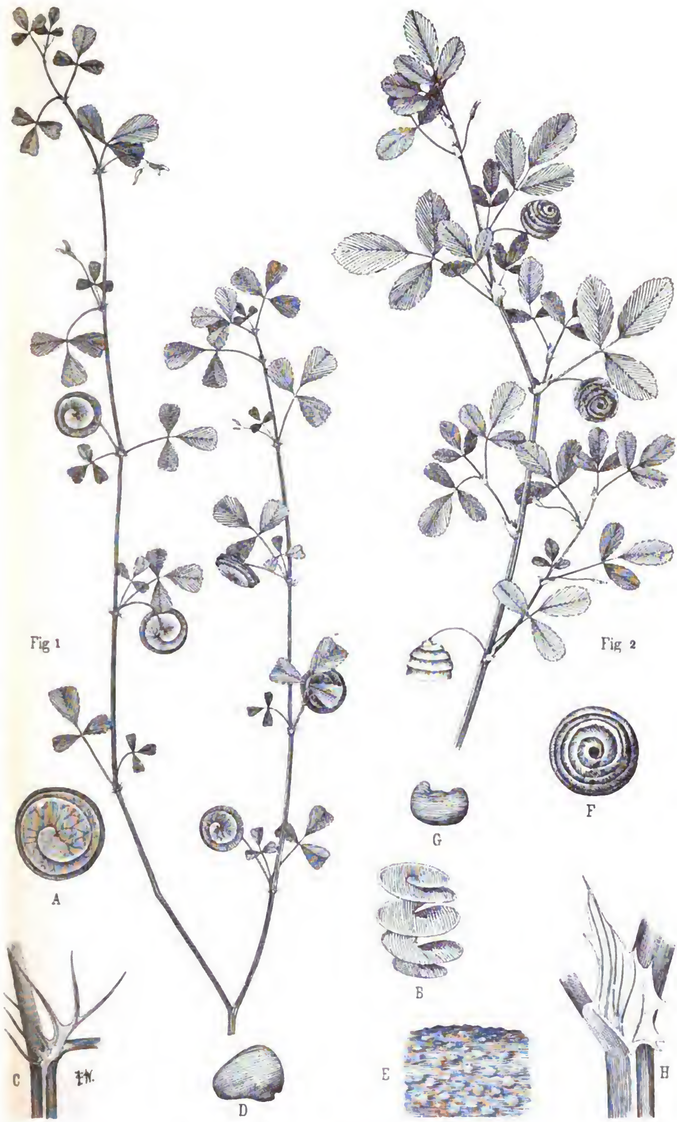
M. orbicularis, All.—Stems diffuse; leaflets obcordate, toothed at the apex; stipules jagged, the segments very narrow and diverging; peduncles 1-2 flowered; legumes cochleate, compressed, glabrous, irregularly and reticulately veined, many-seeded; seeds subtriangular, rugged from dots. Native of the south of Europe.

Note.—It is proposed to figure other species of *Medicago*, *Trifolium* (clover), and other genera of *Leguminosæ*, of paramount interest to the farmer, because of their value as fodder-plants, or because they are a nuisance as weeds.

M. scutellata, Bauhin.—Pilose; stems diffuse; leaflets obovate, toothed around; stipules lanceolate, toothed; peduncles 1-2 flowered; legume cochleate, many-seeded, hemispherically convex above, but flat below, beset with dense, oblique, reticulated veins; the veins thin at the margins, and anastomosing; seeds large, kidney-shaped, smooth, brown. Native of the south of Europe.

The species may be distinguished by the shape of the leaves, the pods (which are flatter and smoother in *M. orbicularis*), the shape of the seeds, and their relative roughness. The flowers of both are small; and yellow. The pod or legume is a spiral, and can be pulled out, with a little force. The French hence call *M. scutellata* "limaçon" or "the snail."

Reference to plate.—*Medicago orbicularis*—A, twisted pod (legume) end view, natural size; B, twisted pod, with spirals torn apart, natural size; C, stipule, magnified; D, seed, magnified; E, surface of seed magnified, showing warted appearance. *Medicago scutellata*—F, twisted pod (legume) end view, natural size; G, seed magnified; H, stipule magnified.



Medicks.

Fig. 1.—Medicago orbicularis, Allioni.

Fig. 2.—Medicago scutellata, Bauhin.

Cape Cotton.

(*Gomphocarpus fruticosus*, R.Br.)

A Useless and Aggressive Weed.

By J. H. MAIDEN.

The plant figured is a native of South Africa, but it was introduced into Australia almost at the foundation of the Colony, doubtless at the time when there was so much traffic between Capetown and Sydney. It grows from 2 to 4 feet high, and even higher; has willow-like leaves, pretty white flowers, which are succeeded by a bladdery-looking fruit (follicle), which is covered with long, soft prickles. These fruits, when ripe, contain numerous seeds, to each of which is attached a tuft of beautiful silky hairs, by means of which it is wafted about by the wind to long distances. When the plant is broken it exudes a milk-white juice.

This plant is now to be found in every one of the colonies, and has found its way a considerable distance inland. Its diffusion is owing to the abundance of its seeds and the silky hairs already alluded to. It therefore is difficult to cope with, as, if all the farmers in a district were to eradicate it from their land, a few neglected plants by a roadside or in a paddock would be sufficient to sow the district again with it.

Even when this plant was cultivated in England under glass, the plant became undesirable because of the way the seeds were blown about. A figure of it was given in the *Botanical Magazine* in the year 1814, and this is what was said of it:—"An old inhabitant of our greenhouses, where it thrives well, and frequently ripens its seeds; but the plant should be removed out of the greenhouse, or the seed vessels plucked off before they burst, otherwise the down of the seeds, being blown about the house, and adhering to whatever it touches, is apt to disfigure all the surrounding foliage."

The botanical name of this weed is *Gomphocarpus fruticosus*, R. Br., and it belongs to the *Asclepiadeæ*. The word *Gomphocarpus* is from two Greek words—*gomphos*, a club, and *carpos*, a fruit; but the name is not particularly appropriate to the plant under discussion. The word *fruticosus* is a Latin one signifying "shrubby."

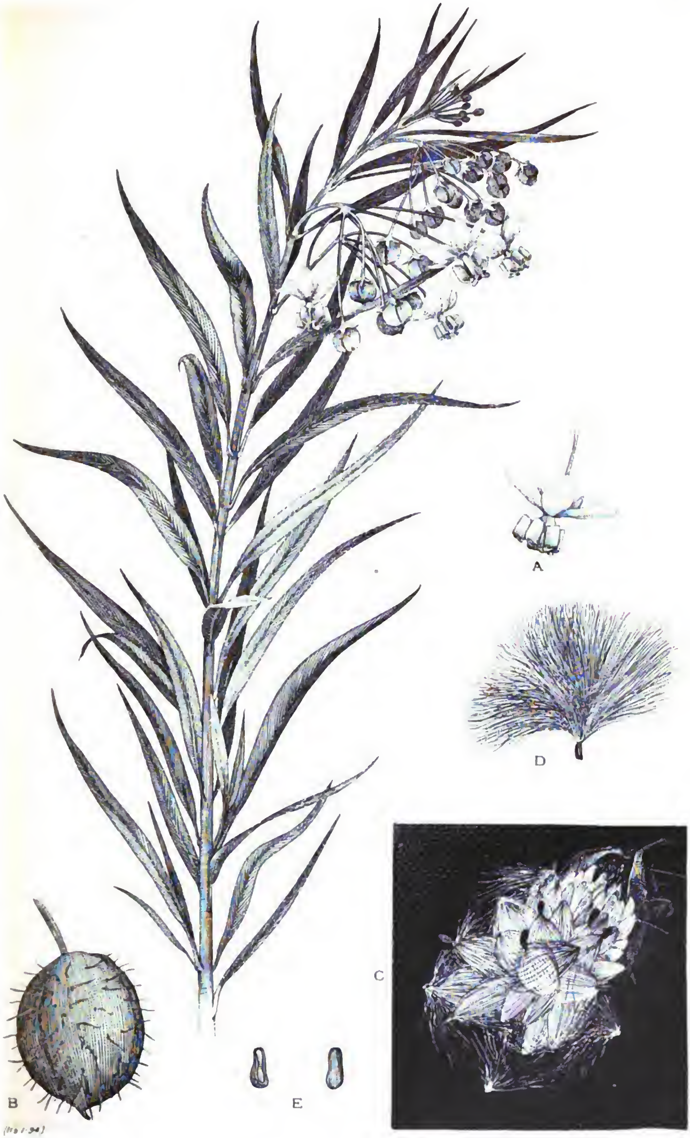
That it belongs to the *Asclepiadeæ* reminds one of the silky-seeded Doubah (*Marsdenia Leichhardtii*) of the west, eaten by the blacks; while other tuberous-rooted species of the genus used to be eaten by them as a substitute for potatoes.

The plant now figured is a weed without any redeeming feature except its good looks. Every care should be taken to destroy it before it seeds. The down from the seeds has been brought to me many a time to inquire if it

has any commercial value. It is absolutely destitute of value for textile purposes, as the fibres are too brittle, and they are otherwise unsuitable for weaving. The only use to which the material could be put would be as a substitute for kapok, and an inferior substitute too, while the collection of it could never be a commercial success in this Colony, as substances of this class, known as "silk cottons," are already very abundant in tropical countries. War must be waged against it, as it takes nourishment from the land, and is of no use to either man or beast.

In Lindley and Moore's "Treasury of Botany," Art. "*Gomphocarpus*," occurs the following passage:—"The leaves of *G. fruticosus*, the Arghel of Syria, are employed for adulterating senna. This plant is sometimes referred to *Solenostemma*." If by this is meant that the *Gomphocarpus* is a *Solenostemma*, the statement is founded on a misapprehension, for *S. argel*, Hayne, which, in Upper Egypt, yields Argel leaves (used for adulterating Alexandrian senna), is a different plant from *Gomphocarpus fruticosus*. It is figured table 175 of Bentley and Trimen's 'Medicinal Plants,' and those who desire further information in regard to it are referred to the 'Kew Bulletin' for 1891, p. 177. So that our introduced *Gomphocarpus* is useful for nothing,—not even as an adulterant."

Reference to Plate.—A, flower, May; B, fruit (follicle); C, fruit opening; D, seed with long tuft of silky hairs or coma; E, seed, front and back views.



Gomphocarpus fruticosus, R. Br.

"Wild or Cape Cotton," naturalized from South Africa.

Botanical Notes

By J. H. MAIDEN.
Consulting Botanist.

A Native Senna.

The Inspector of Stock at Warialda sends twigs of a shrub which is spreading in the neighbourhood of the Macintyre River, and asks whether it is injurious to stock. It is one of our native sennas, and its botanical name is *Cassia sophera*, Linn., var. *schinfolia*. Cassias belong to the natural order *Leguminosæ*, and some of them (of which this is one) contain an active principle which causes the leaves, bark, &c., to be purgative to man and animals. The present species may, therefore (if stock take to eating it), purge horses and cattle, but it must not be looked upon as harmful or poisonous. Some of our cassias are useful fodder-plants. At the same time, we have but little direct knowledge of the effect of cassias on stock, and I should be glad if correspondents would favour the Department with their observations on the subject. Some years ago a friend (who knows cassias), reported that they had been purging his horses, but I did not get specimens, and am unable to say what species was referred to.

The typical species is largely used in native medicine in India. Waring's "Pharmacopœia of India" mentions that an extract of the leaves is a good substitute for colocynth. The bark and seeds are likewise used as a cathartic. In Ceylon, the native doctors fry the leaves of this and allied species in castor oil, the strained product being used as an ointment for ringworm and other skin diseases. In India the plant is largely put to a similar use. In addition, the natives of tropical Asia put it to uses which appear to us more or less fanciful. Although it is not likely that the two medical uses indicated for this plant will (other remedies being available), be largely used in this Colony, it is sometimes advantageous, particularly to people away in the bush, to know the properties of the plants in their neighbourhood. If they are not required to be used, so much the better.

The Corn Gromwell (*Lithospermum arvense*, Linn.).

Mr. John Coleman, of the Experimental Farm, Wagga Wagga, sends the Department a plant which is named above, and asks for information concerning it. It is native of Great Britain, Europe, Asia, and North Africa, and has been introduced into this country for very many years, probably with dirty seed. In the old country it is found in wheat-fields (and other cereal crops), and in waste places. It has white flowers, not very showy, and is hairy. It will be observed that its root is red, and strongly resembles

alkanet. In fact, it yields a dye equal in quality to alkanet, but in less quantity. Alkanet, it will be remembered, belongs to the same natural order—the *Boragineæ*, or Borage family. Our Gromwell is hence often known as Painting root, and in Sweden at the present day it is still employed to make a red dye instead of the true alkanet. It is not a difficult plant to eradicate, but while it is quite destitute of poisonous properties, on the other hand it has not, in these days of aniline dyes, any commercial value for tinctorial purposes.

Gnaphalium Japonicum, Thunb.

An introduced weed belonging to the daisy family (*Compositæ*), has been sent from Wagga Wagga as "Take-all," and must be added to the already formidable list of weeds to which "Take-all" has been vaguely attributed.

Experiments with Pulses.

(*Continued from Vol. IV, page* 917.)

By GEORGE VALDER.
Department of Agriculture.

The Kidney or French Bean (*Phaseolus vulgaris, Linn.*)

Twenty varieties were sown, ten of the green-podded and ten of the yellow-podded (butter or wax beans). The seeds were sown in drills 2 feet apart by 4 to 5 inches apart in the drill. One drill 33 feet in length was sown of each variety. The soil was not broken up as fine as it should have been for this crop, and the plants were not watered, but the plot was kept free from weeds and the weather was very suitable, being warm and very showery for the first six weeks after sowing. The crop therefore grew strongly, and the experiment proved in every way a success, every variety maturing its seed. All the yellow-podded varieties were attacked more or less by "bean rust," the result being that the yield of these did not compare favourably with that of the green-podded varieties which were almost entirely free from this disease. From my experience I have found that the yellow-podded varieties are always much more liable to "bean rust" than the green-podded ones, the latter rarely being affected. About three months after sowing, the weather being warm and dry, the beans ripened rapidly. The pods were gathered as fast as they ripened and were placed in thin calico bags and hung up in a shed to dry.

The following table will show the comparative results obtained:—

No.	Name of Variety.	Obtained from	Germinated in No. of days.	Came into bloom in No. of days.	1st edible pod, No. of days.	1st ripe, No. of days.	Yield of dry beans per drill of 33 feet.
							lb. oz.
1	Emperor William	Hockings, Brisbane	6	38	53	81	2 9
2	Prof. Blount's Blue	W. Farrer, Tharwa, Queanbeyan ..	7	43	53	72	3 8
3	Canadian Wonder	....	8	39	50	78	5 2
4	Pale Dun	....	7	35	46	74	4 11
5	Negro	....	8	38	51	79	4 9½
6	Governor Denison	....	8	36	50	78	3 5
7	Dwarf Zion House	Hockings, Brisbane	6	36	48	73	3 9
8	Carter's White Advancer ..	E. & W. Hackett, Adelaide	7	40	50	81	4 2
9	Dwarf White Caseknife ..	" " "	6	36	49	74	2 7
10	Haricot	D. Manson, Albion Park	6	42	51	77	3 4
11	German Black Wax	Yates, Sydney	6	39	49	81	1 15
12	" "	Shepherd & Co., Sydney	8	38	59	77	1 14
13	New Caledonia Black Wax ..	Parker & Co., Sydney	7	44	60	86	2 9
14	Golden Butter	Horton, Sydney	7	43	52	78	2 3
15	Yosemite Mammoth	P. L. C. Shepherd & Son, Sydney ..	7	40	58	73	2 14
16	White Wax Bean	Yates, Sydney	8	40	49	76	1 8
17	Green Gem	Adamson & Co., Melbourne	6	38	50	74	2 11
18	Golden Wax	Yates, Sydney	7	40	52	75	2 1
19	Dwarf Mont D'Or	Anderson & Co., Sydney	7	41	53	72	2 11
20	Golden Mountain	W. Farrer, Tharwa, Queanbeyan ..	7	39	51	76	2 6

Of the green-podded varieties the following gave by far the best results :—Canadian Wonder, Carter's White Advancer, Negro, and Pale Dun.

Of the yellow-podded varieties I consider the following are most worthy of cultivation here :—Yosemite Mammoth, Dwarf Mont D'Or, and Golden Wax.

Green Gem and New Caledonia Black Wax, two light green-podded varieties, are also very productive and of a fine flavour.

Short descriptions of all the varieties under trial are given herewith.

1. *Emperor William.*—Plants 12 to 15 in. high; strong and upright in habit; flowers, cream to white; pods 4 to 6 in. long; nearly straight and very fleshy; seeds white, oval and plump; a good table variety of fine flavour, but rather a shy bearer.

2. *Prof. Blount's Blue.*—Plants upright and strong, but very irregular; 12 to 18 in. high; flowers violet; pods 5 to 6 in. long, well filled; seeds small, dark crimson, nearly black; a very good variety.

3. *Canadian Wonder.*—Plants large and strong; 18 to 20 in. high; much branched; leaves large and coarse; flowers pink; pods very large and numerous; rather rough; beans large; nearly twice as long as broad; dark crimson nearly black; the hardiest, strongest grower and heaviest yielder of all.

4. *Pale Dun.*—Plants very large; much like No. 3, but leaves are darker and the flowers are white; pods 5 to 6 in. long, straight and tender; beans light dun; one of the best.

5. *Negro.*—Plants 15 to 18 in. high; much branched; leaves rather large and coarse; medium green; flowers violet; pods 5 to 7 in. long; beans quite black; a heavy yielder and one of the best for culinary purposes.

6. *Governor Denison.*—Plants much resemble No. 5, but flowers are white; pods long, straight and succulent; beans white splashed with crimson. This variety appears to be very suitable for warm districts, as on the hottest day the leaves do not droop, and with a fair amount of moisture it always yields well.

7. *Dwarf Zion House.*—Plants 15 to 18 in. high, upright; branches slender with small leaves; pods 4 to 6 in. long, slightly curved; seeds much like No. 6, but splashed with a darker crimson and not so large; a very fair variety; stands heat well.

8. *Carter's White Advancer.*—Very strong growing plants, with light green foliage; flowers white; pods very large, 6 to 8 in. long; beans white, large; an excellent variety, superior to Canadian Wonder for tenderness and flavour, but not nearly equal to it in yield.

9. *Dwarf White Caseknife.*—Plants 15 to 18 in. high; stems slender and inclined to short runners; leaves dark green, rather large; flowers white; pods were long, but did not fill out very well; beans white, sides slightly flattened.

10. *Haricot.*—Very similar to above, but stronger in growth; pods long and well filled; beans pure white, very plump.

11. *German Black Wax.*—Plants 12 to 15 in. high; strong growing and much branched; leaves large, medium green; flowers violet; pods 4 to 5 in. long, not very numerous, but well filled; yellow and nearly stringless; medium rusty.

12. *German Black Wax.*—Similar in habit to No. 11, but not so strong in growth and both pods and beans smaller; very rusty.

13. *New Caledonian Black Wax.*—This is really a dwarf climber; stems slender and leaves small; plants much branched; pods small but very numerous; light green; very fine flavour; beans small, quite black; almost free from rust.

14. *Golden Butter.*—Plants tall and very robust; leaves large and rather coarse, medium green; flowers violet; pods about 4 in. long, thick and succulent; beans black, large and nearly round; medium rusty.

15. *Yosemite Mammoth.*—Plants 15 to 18 in. high, strong, much branched; leaves large, medium green; pods long, slightly curved, stringless, very succulent and of a beautiful golden yellow colour; a very fine table variety, nearly free from rust.

16. *White Wax.*—Plants 12 to 15 in. high, not very strong; leaves small, pale green; flowers white; pods very numerous, rather small, nearly straight, light yellow; beans dull white; very rusty.

17. *Green Gem.*—Plants fairly strong, 15 to 18 in. high; leaves small, pale green; flowers white; pods light green, rather small, narrow and straight; beans long, narrow, and rather small, of a peculiar light green colour when dry; a very distinct variety, productive, and of excellent flavour; nearly free from rust.

18. *Golden Wax.*—Plants 12 to 15 in. high, not strong; leaves small, rough, pale green; flowers dull white; pods numerous, 4 in. long, rather wide and curved; beans rather small, white speckled with red; very rusty.

19. *Dwarf Mont D'Or.*—Plants tall and slender; leaves small, rather a deep green; flowers violet; pods 4 to 5 in. long, narrow, curved, very plump, bright yellow; beans nearly round, shining, deep purple, nearly black; a very productive and good table variety, but slightly rusty.

20. *Golden Mountain.*—Resembles No. 19, but the pods are much flatter, and nearly white; although very rusty, gave a very fair yield.

Notes on Ringbarking and Sapping.

Based on Foresters' Reports.

Compiled and Annotated by J. H. MAIDEN.

The following circular is self-explanatory:—

Department of Mines and Agriculture, Forests,
Sydney, 12 July, 1893.

As it is deemed desirable to procure some reliable information as to the best method and time for ringbarking and destroying useless timber, I have to request that you will be good enough to furnish any information you may have gained under the following heads:—

1. At what time of the year the ringbarking or sapping proves most effective.
2. At what time ineffective.
3. The kind of timber that is most easily destroyed, and the kind that is the reverse.
4. Whether you consider trees should be sapped or simply ringbarked.

Also any other information that may be useful to the Department, especially the effect of ringbarking on the grasses.

W. S. CAMPBELL
(For the Under Secretary).

It was addressed to all foresters, from the greater number of whom replies, more or less full, have been received.

In the answers to the several questions I have interfered with the wording of the replies as little as possible, so that the foresters may use their own words. Even where the reports of several foresters practically amount to the same thing, it is often suggestive to have the position expressed by a different form of words. Where alterations have been made for clearness or compactness' sake, it is chiefly because the replies have been given in some instances in the form of a continuous report, instead of keeping the reply to each question separate from the others.

I have arranged the foresters' districts as far as possible in fairly well-defined climatic groups as follows:—

1. North Coast.
2. Central Coast.
3. South table-land and South Coast.
4. North table-land.
5. Dry plain country mainly.
6. Murrumbidgee and Murray.

Following are the names of the foresters who have reported and their head-quarters.

NORTH COAST.

Foresters.	Head-quarters.
Pope	Murwillumbah.
Huxham	Grafton.
Mecham	Bellinger.
Macdonald	Kempsey.
Brown*...	Port Macquarie.
Angus Kennedy	"
J. McLennan	"
J. Downes...	"
Rudder	Booral.

* Mr. Angus Kennedy, Mr. J. McLennan, and Mr. J. Downes, in this forester's district, have also been kind enough to furnish information on the subject, and their replies will be found in the proper place.

CENTRAL COAST.

Cobcroft (not actually touching coast)	Singleton.
Brunker, assistant	Ellalong.
Martin	Gosford.
Stopford (part)	Penrith.

SOUTH TABLE-LAND AND SOUTH COAST.

Rotton	Picton.
Allan	Milton.
Benson	Bega.
Jennings, assistant	Queanbeyan.

NORTH TABLE-LAND.

Crowley	Casino.
Deverell	Glen Innes.
Siddins	Armidale.
Kingsford	Gunnedah.
Marriott	Mudgee.
Stopford (part)	Penrith.

DRY PLAIN-COUNTRY MAINLY.

McGee	Narrabri.
King	Coonamble.
Smith	Dubbo.
Kidston...	Condobolin.
Postlethwaite, assistant	Grenfell.
Taylor	Wagga Wagga.
Martin	Dubbo.

Mr. Martin was forester at Dubbo at the time he obtained the information which he has supplied in regard to western timbers. He is now stationed at Gosford.

MURRUMBIDGEE AND MURRAY.

Manton, inspecting	Moama.
Condell	Narrandera.
Wilshire	Deniliquin.
Chanter...	Koondrook.
Guilfoyle	Moama.
Payten	Corowa.

Following are the replies:—

1. At what time of the year the ringbarking or sapping proves most effective.

North Coast.

Forester Pope, Murwillumbah.—August to December, "when the sap is up."

Forester Huxham, Grafton.—Midsummer is the most effective time for sapping trees.

Forester Mecham, Bellingen.—End of January to not later than the end of March.

Forester Macdonald, Kempsey.—It seems reasonable to suppose that ringbarking should prove most effective in the spring when the sap is in full circulation, and the tree bearing its best foliage, but much depends on climatic conditions, and the kinds of timber to be dealt with. In this North Coast District, where there is generally a great variety of timbers (mixed), and all coming under the operation of the axe at the same time, no definite rule can be laid down which would apply to all districts, and prove to be an unexceptionable guide. The most effective ringbarking that I have seen in this district was performed in the autumn, or between the 1st of February and the 30th of April, after a wet summer. One advantage of ringbarking at this time of the year is that any suckers which may shoot from the stumps have not time to gather sufficient strength to withstand the frosts of June and July.

Forester Brown, Port Macquarie.—When the tree is full of sap, and just before it starts to come down. I might instance a case of ringbarking, contradicting the general opinion as to certain definite months for ringbarking, *e.g.*, on "Yarras" Station on the Hastings River, 45 miles from here; with ridgy, undulating, and flat country; timber, gum, box, stringy bark, and apple tree, &c.; operated on at all seasons, as the chance came of men travelling for work; no suckers grew; this was principally ringbarked; about 4 to 6 inches of the bark off all round the tree. The soil is light red, and abundance of a sort of slaty gravel on the ridges with the wash on the flats; the grasses on this station are considered excellent, yet all the timber has been rung.

Mr. Angus Kennedy, Port Macquarie.—December and January. When done in these months the trees will mostly sprout in March; the sprouts will then be weakly when the frost comes on, and they seldom grow the following year.

Mr. J. M'Lennan, Yarras, Port Macquarie District.—During the summer months nearly all our forest trees have the sap up (except bloodwood and tallow-wood, which blossom in winter). If then ringbarked 3 inches wide and ½ inch deep, they will die quickly and not throw up suckers; sapping not needed.

Mr. Downes, Rawdon Island, Port Macquarie District.—March, April, May.

Forester Rudder, Booral.—A great deal depends on the season, whether wet or dry. Generally speaking, the best time is when the sap is well up. There are first-class results of ringbarking near here, done in March; the trees are all dead, and there is no suckering.

Central Coast.

Forester Cobcroft, Singleton.—October.

Forester Martin, Gosford.—June, July, and August. It is thought by many persons that ringbarking operations should only be performed when the sap is either up or down. This, I think, is only partially correct, as the circulation of sap in a tree is always going on more or less, and it is made active after a day's soaking rain in any month of the year.

Forester Stopford, Penrith.—February.

South Table-land and South Coast.

Forester Rotton, Picton.—Ringbarking or sapping proves most effective when the sap is up, in the months of November, December, January, February, March, and the beginning of April.

Forester Allen, Milton.—January and February in coast districts. Should it be a wet season, the trees die well, and are not followed by any second growth. July and August in the Jingera and Monaro districts, according to local residents.

Forester Benson, Bega.—End of February. The forest growth has pretty well ended in February in this district.

Forester Harris, Queanbeyan.—About the end of summer, "when the sap is well up." It is difficult to define any exact month in the year for ringbarking, as it must depend a good deal on the seasons, and also on the kind of country to be rung, and it must be remembered that ringbarking is always more effective after a shower of rain. Experience alone will suggest the proper time to ringbark.

North Table-land

Forester Crowley, Casino.—Beginning of December, in hilly or ridgy country, to end of April. Near the coast in flat country the timber should be ringbarked from April to August.

Forester Deverell, Glen Innes.—As regards what time of year best to ring, I must say that no set month or regular time can be stated, as it mostly, as far as my experience goes, depends on the season and soil, *i.e.*, it must be done when the sap is up, which occurs generally on good soils in the eastern parts about January or February, and in bad soils even later; while in the western part about a couple of months earlier, viz., November or December.

Forester Siddins, Armidale.—I have always found ringbarking most effective when the sap is up, which occurs after heavy rains, when the operation can be performed with the certainty of the trees dying without producing suckers. It is particularly effective when rains fall from the middle of spring to the middle or end of the autumn.

Forester Kingsford, Gunnedah.—During the late summer months, February and March, when the sap is up. Some persons consider that the winter months, July and August, are best for the purpose, the sap then being "down"; but, in this latter case, the stump is liable to "sucker" at and below the ring when the sap again commences to ascend. In any case I do not consider it prudent to operate in any months, other than those stated, during which the sap is in circulation, the work of killing the trees being thus rendered more difficult.

Forester Marriott, Mudgee.—Early autumn during the months of February, March, and April, when the sap is at its height, and the work of flowering and fruiting is over. As, however, different trees vary in their periods of flowering, this cannot be laid down as a general rule; it is necessary when ringbarking a stretch of country—if it is to be effectively carried out—to notice this difference, and not ringbark promiscuously. Latitude and altitude also bear upon the latter point.

Dry Plain Country Mainly.

Forester M'Gee, Narrabri.—The best time of the year to ringbark or sap trees is during the spring and summer months when the sap is up, particularly after rain, at which time sap is most abundant.

Forester King, Coonamble.—May or June, as, if the trees should throw out suckers, their growth would be checked during the summer months.

Forester Kidston, Condobolin.—December and January, unless they are wet.

Assistant-Forester Postlethwaite, Grenfell.—December, January, February. Suckers will generally put out in six or eight months, and if done in summer have another summer to contend against, and being small and weak the hot sun will frequently scorch and kill them before gaining strength, but if rung in the winter they have the whole of the following winter to mature.

Forester Taylor, Wagga Wagga.—As early in the autumn as possible.

Murrumbidgee and Murray.

Inspecting-Forester Manton, Moama.—The summer.

Forester Condell, Narrandera.—November, December, January, when the sap is well up in the timber.

Forester Wilshire, Deniliquin.—October to March, the sap being then well up.

Forester Payten, Corowa.—March, April, May, June, July. I have noticed that red-gum trees when sapped during the latter end of March die out and but few suckers appear, though trees sapped in March cause the land to be strewn with dead timber shortly after, consequent upon the flow of sap in the trees at that time, which hastens decay, and trees rung in the winter when the sap is less active cause the trees to linger for, say, twelve months before they die.

Forester Guilfoyle, Moama.—January, February, and the greater part of March. It is always better to wait till the new growth of the tree has made some progress. By ringbarking at that period the check will be greater than if the work is done immediately after the new growth commences. The evaporation from the foliage of such trees as red-gum and box is much greater after the new growth has made some headway than at starting, and consequently the more severe the check to the vitality of the tree when the sap current is broken. It must be borne in mind that in dealing with this most important matter of ringbarking, local conditions of climate and kind of tree should always receive due consideration. Fifty or sixty miles up or down the Murray from any given point might possibly be a different climate, so that some judgment in regard to the exact time to begin ringbarking or thinning is absolutely necessary. It means simply to watch for the time when the bark strips freely, and then to go to work as rapidly as possible.

The information contained in the foregoing replies will be clearer if the months recommended for ringbarking are put in tabular form:—

Forester.	Head Quarters.	Months recommended.
	North Coast.	
Pope	Murwillumbah ...	August to December.
Huxham	Grafton	January.
Mecham	Bellingen	January 31 to March 31 (at latest).
Macdonald	Kempsey	February 1 to April 30.
Brown	Port Macquarie ...	
Angus Kennedy	,, ...	December, January.
J. McLennan ...	,, (Yarras.) ...	Summer months.
Downes	Port Macquarie (Rawdon Id.) ...	March, April, May.
Rudder	Booral	When sap well up; March, &c.
	Central Coast.	
Cobcroft	Singleton	October.
Martin	Gosford	June, July, August.
Stopford	Penrith	February.
	South Table-land and South Coast.	
Rotton	Picton	November to end of March.
Allan	Milton	January, February (for Coast); July, August (Jingera and Monaro).
Benson	Bega	End of February.
Harris	Queanbeyan ...	End of summer.
	North Table-land.	
Crowley	Casino	December to end of April (hilly country); April to August (flat coast lands).
Deverell	Glen Innes ...	January, February (eastern slope); November, December (western slope).
Siddins	Armidale	Middle of spring to middle or end of autumn.
Kingsford	Gunnedah... ...	February, March.
Marriott	Mudgee	February, March, April.
	Dry Plain Country Mainly.	
McGee	Narrabri	Spring and summer.
King	Coonamble ...	May, June.
Kidston	Condobolin ...	December, January.
Postlethwaite ...	Grenfell	December, January, February.
Taylor	Wagga Wagga ...	Early autumn.
	Murrumbidgee and Murray.	
Manton	Moama	Summer.
Condell	Narrandera ...	November, December, January.
Willshire	Deniliquin ...	October to March.
Payten	Corowa	March to July.
Guilfoyle	Moama	January, February, March.

From perusal of this table it is at once seen that no one month, or series of months,* is best for ringbarking in all seasons and in all parts of the Colony. This point is emphasised by most of the foresters, some of whom point out the necessity for noting local experience. This is, of course, the truest guide, as a general rule. Speaking generally, it is recommended, almost without exception, to ringbark when the sap is up, for the reasons stated in slightly different language by different foresters. As one forester puts it, "Watch for the time when the bark strips freely, and then go to work as rapidly as possible."

Months recommended for ringbarking.

Months.	North Coast.	Central Coast.	South Table-land and South Coast.	North Table-land.	Dry plain country mainly.	Murrumbidgee and Murray.	Total "votes."
January ...	3	......	2	3	3	4	15
February ...	3	1	4	5	2	3	18
March	4	......	1	4	1	3	13
April	2	......	......	4	......	1	7
May	1	......	......	1	1	1	4
June	......	1	......	1	1	1	4
July	......	1	1	1	......	1	4
August... ...	1	1	1	1	......	......	4
September ...	1	......	......	......	1	......	2
October ...	1	1	......	1	1	1	5
November ...	1	......	1	2	1	2	7
December ...	3	......	1	3	3	3	13

Explanatory.—In compiling the above statement, spring has been interpreted to mean September to November; summer, December to February; autumn, March to June.

Taking the Colony as a whole, it will be observed that the months most recommended for ringbarking are from December to March, while February is preferred. The numbers in the columns show the number of "votes" given per district for each month, so that the desirability or not of ringbarking in any particular district during any month may be at once seen.

2. At what time ineffective?

The answers are, in the main, the converse of those given in reply to No. 1, so they need not be tabulated or discussed at length. The general opinion is that ringbarking is inexpedient in the winter months.

North Coast.

Forester Huxham, Grafton.—Winter.

Forester Mecham, Bellingen.—Ineffective so far during the winter months and when the sap is rising, when, if ringbarked, suckers grow from the stump and roots, causing a heavy undergrowth.

Forester Macdonald, Kempsey.—The time at which the operation would generally prove most ineffective is in midwinter or the dry season, when there is a partial suspension of the sap, and the chief vitality of the tree is in the root. The reason is obvious. If the operation is performed at such a time, the root and stump of the tree being in full vigour, it has a powerful

* If it is absolutely necessary to give a season, summer is the best.

tendency (with the rising of the sap) to throw out a new growth in the form of suckers, the destruction of which often costs far more than the ringbarking.

Forester Brown, Port Macquarie.—I have not observed.

Mr. Angus Kennedy, Port Macquarie.—Early in the season (spring), because the sprouts then grow strong and able to withstand the frost the following winter.

Forester Rudder, Booral.—Generally the dry time. When the sap is down.

Central Coast.

Forester Cobcroft, Singleton.—Nil.

Forester Martin, Gosford.—Spring and summer months. This also expresses the result of Mr. Martin's experience at Dubbo.

Forester Stopford, Penrith.—July or August.

South Table-land and South Coast.

Forester Rotton, Picton.—When the sap is down, in the months of May, June, July, August, September, and October. I do not say that ringbarking or sapping done in these months will not destroy the trees, but they are almost sure to throw out suckers, and give more trouble than if done the proper season.

Forester Allan, Milton.—Winter months, *i.e.*, when the sap is down. At the same time the sap flows at different periods in the case of different trees.

Forester Benson, Bega.—Winter or spring months. To ring them then is throwing money away. If the land is timbered heavily, suckers will spring up in abundance causing more to eradicate than the ringing.

Forester Harris, Queanbeyan.—Winter.

North Table-land.

Forester Deverell, Glen Innes.—I consider that for all practical purposes it is ineffective to ringbark or sap during the winter months, first because it takes a long time to kill, if ever, and secondly because it generally produces suckers, especially in this district with stringybark and box.

Forester Siddins, Armidale.—It is not effective during the winter as a rule, or a drought, or when the sap is down, as on its rising suckers are forced out below the cut, and these are extremely difficult to destroy.

Forester Marriott, Mudgee.—During the spring and early summer, when the trees are making fresh wood.

Dry Plain Country Mainly.

Forester McGee, Narrabri.—The winter months generally prove unsatisfactory for sapping or ringbarking, as the sap is all down in the roots of the trees then. When the sap rises in the spring it cannot get further than the ring, and consequently throws out suckers all round the tree. The tree dies, but the suckers flourish and are as much trouble to kill as the tree. During moist and wet seasons trees ringbarked or sapped frequently throw out suckers more or less, as sap is then plentiful.

Forester King, Coonamble.—During the hot weather. It is probable the shoots would grow very rapidly during the winter months, especially if a wet season ensues.

Forester Kidston, Condobolin.—After heavy rain, followed by warm weather.

Assistant-Forester Postlethwaite, Grenfell.—July, August.

Forester Taylor, Wagga Wagga.—In the spring.

MURRUMBIDGEE AND MURRAY.

Inspecting-Forester Manton, Moama.—In the winter.

Forester Condell, Narrandera.—Winter and spring months. Trees ringbarked during these months throw out suckers and shoots, as the sap rises to where the tree has been rung.

Forester Wilshire, Deniliquin.—The autumn and winter months.

Forester Payten, Corowa.—Sap-ringing would be effective at any time, only if done during spring or summer the trees would throw out suckers, thereby causing the work to be done over again, and if the trees are ringbarked during that period, and wet weather sets in, it would in many cases cause the sap to unite.

Forester Guilfoyle, Moama.—The ringbarking or sapping of "red gum" (*Eucalyptus rostrata*), or "box gum" (*E. hemiphloia*), two of our very best timbers, should by no means ever be attempted in the winter season, for the simple reason that the sap at that time is not in an active state, or what bushmen call "up." The work would be useless, to say the least of it.

3. The kind of timber that is most easily destroyed and the kind that is the reverse.

This is a very important question, and, after the replies have been read, it will be found necessary to examine the tabulated forms and brief summaries at the end, in order to grasp the replies. While there is little or no doubt as to the facility (or the reverse), with which certain trees may be killed by ringbarking or sapping, one must be careful not to generalise too much upon the data before us. There is great diversity as to the number of trees referred to by individual foresters. Some foresters have hardly specified a single tree, while others have named a good many. It is obvious, therefore, in counting the "votes" as to whether a certain species of tree is easy or difficult to kill, the trees referred to by foresters who have supplied long lists will monopolise the votes. The only way to exhaustively ascertain whether certain timbers are easy to kill, or the reverse, would have been to have requested each forester to report upon twenty specified trees, but, as it is, a good deal of valuable information has been secured.

In some instances it has not been possible to give the scientific name with absolute certainty (owing to non-receipt of flowers and fruit); in these cases it has been omitted, or a query put in front of the name. These botanical names have been given wherever possible, in order to properly define the trees referred to, as local names are often vague. In a few instances the replies might well have been a little fuller, but, taking them as a whole, they impart useful information.

NORTH COAST.

Forester Pope, Murwillumbah.—Easiest: All kinds of timber (except stringybark) are on an equality as regards destruction by ringbarking. Most difficult: Stringybark (*Eucalyptus acmenoides*).*

*[NOTE.—This tree is usually known as white mahogany, but it has a fibrous bark, hence the name of stringybark in the district. Fruits of the tree referred to have been received from Mr. Pope.]

Forester Huxham, Grafton.—Easiest: All our forest timbers. Most difficult: Soft brush timbers.

Forester Mecham, Bellingen.—Easiest: Turpentine (*Syncarpia laurifolia*); gum (the smooth-barked eucalypts); ironbark (*Eucalyptus paniculata*); blackbutt (*Eucalyptus pilularis*); tallow-wood (*Eucalyptus microcorys*); grey gum (*Eucalyptus saligna var.*); white mahogany (*Eucalyptus acmenoides*); red mahogany (*Eucalyptus resinifera*). Most difficult: Brush or white box (*Tristania conferta*); forest oak (*Casuarina suberosa* mainly); bloodwood (*Eucalyptus corymbosa*); these require heavy sapping to ensure success.

Forester MacDonald, Kempsey.—Easiest: Apple-tree (*Angophora subvelutina*); ironbark (*Eucalyptus paniculata*); forest oak (*Casuarina torulosa*); stringybark (*Eucalyptus eugenioides*). Most difficult: Blackbutt (*Eucalyptus pilularis*); spotted gum (*Eucalyptus maculata*); grey gum (*Eucalyptus saligna* and *tereticornis*).

Forester Brown, Port Macquarie.—Easiest: Stringybark (*Eucalyptus eugenioides*); mahogany (*Eucalyptus resinifera*); stinking or broad-leaf gum (*Eucalyptus sp.*) (It will be observed that the experience of Mr. Forester Brown and Mr. J. McLennan do not agree as regards the stinking or broad-leaf gum.)

J. McLennan, Yarras.—Easiest: Stringybark (*Eucalyptus eugenioides*); grey box (*Eucalyptus hemiphloia*); ironbark (*Eucalyptus paniculata, &c.*); forest oak (*Casuarina torulosa*); bloodwood (*Eucalyptus corymbosa*); tallow-wood (*Eucalyptus microcorys*); red or scrub box (*Tristania conferta*); blue gum (*Eucalyptus saligna*). Most difficult: White or ribbon gum (*Eucalyptus viminalis*); broad-leaf or stinking gum (*Eucalyptus sp.*)

Angus Kennedy, Port Macquarie.—Easiest: Ironbark (*Eucalyptus paniculata*); box (*Eucalyptus hemiphloia*); apple (*Angophora subvelutina*); grey gum (*Eucalyptus tereticornis*). Most difficult: Stringybark (*Eucalyptus eugenioides*); blue gum (*Eucalyptus saligna*); flooded gum (*Eucalyptus saligna*).

Forester Rudder, Booral.—Easiest: Bloodwood (*Eucalyptus corymbosa*); ironbarks (*Eucalyptus paniculata, siderophloia, &c.*); blue gum (*Eucalyptus saligna*); flooded gum (*Eucalyptus saligna*); grey gum (*Eucalyptus saligna var.*); turpentine (*Syncarpia laurifolia*); red mahogany (*Eucalyptus resinifera*); stringybarks (*Eucalyptus eugenioides* and *macrorrhyncha*); tallow-wood (*Eucalyptus microcorys*); river oak (*Casuarina Cunninghamiana*); forest oak (*Casuarina torulosa*). Most difficult: Brush box (*Tristania conferta*); tea-trees (*Melaleuca spp.*); swamp oaks, viz., forest swamp oak (*Casuarina glauca*), and coast swamp oak (*Casuarina stricta, quadrivalvis*); spotted gum (*Eucalyptus maculata*); red gum (*Eucalyptus tereticornis*); grey box (*Eucalyptus hemiphloia*). These are usually hard to kill, or sucker a good deal. Brush or scrub trees are very deep in the sap, and are mostly hard to kill.

Central Coast.

Forester Cobcroft, Singleton.—Easiest: Ironbark (*Eucalyptus crebra, &c.*); box (*Eucalyptus hemiphloia*). Most difficult: Tea-tree (*Melaleuca spp.*).

Forester Martin, Gosford.—Easiest: Box (*Eucalyptus hemiphloia*); apple (*Angophora lanceolata*); blackbutt (*Eucalyptus pilularis*); stringybark (*Eucalyptus eugenioides*); ironbark (*Eucalyptus paniculata, &c.*); blue gum (*Eucalyptus saligna*); red gum (*Eucalyptus tereticornis*); grey gum

(*Eucalyptus tereticornis*). Most difficult: Flooded gum (*Eucalyptus saligna*); mahogany (*Eucalyptus resinifera*); spotted gum (*Eucalyptus maculata*).

South Table-land and South Coast.

Forester Rotton, Picton.—Easiest: All. Most difficult: Red box (*Eucalyptus polyanthema*) (?); peppermint (*Eucalyptus piperita*); bangallay (*Eucalyptus botryoides*); blue gum (*Eucalyptus saligna*); grey gum (*Eucalyptus tereticornis*); white box (*Eucalyptus hemiphloia*).

Forester Allan, Milton.—Easiest: Nearly all our eucalypts, and the majority of brush trees. Most difficult: Fig (*Ficus rubiginosa*); stinging-tree (*Laportea gigas* and *L. photiniphylla*); kurrajong (*Sterculia diversifolia*).

Forester Benson, Bega.—Easiest: Not stated. Most difficult: Peppermint (*Eucalyptus piperita*); black box (*Eucalyptus longifolia* (?); stringybark (*Eucalyptus eugenioides*); as they throw more suckers than other kinds of timber. [The black box of this district is known as woollybutt in other parts of the Colony.]

Forester Harris, Queanbeyan.—Most easily: Gum (*Eucalyptus*, smooth barked species); apple (*Eucalyptus stuartiana*), stringybark (*Eucalyptus macrorrhyncha*); box (*Eucalyptus hemiphloia*); in the order named. Most difficult: Peppermint or messmate (*Eucalyptus amygdalina, var.*) is the hardest tree of all to kill, on account of the innumerable suckers that appear; it should be rung at a different time, viz., winter.

North Table-land.

Forester Crowley, Casino.—Easiest: Ironbark (*Eucalyptus siderophloia*); red gum (*Eucalyptus tereticornis*); bloodwood (*Eucalyptus corymbosa*); apple-tree (*Angophora subvelutina*); oaks (*Casuarina spp.*). Most difficult: Spotted gum (*Eucalyptus maculata*); blackbutt (*Eucalyptus pilularis*); tallow-wood (*Eucalyptus microcorys*); stringybark (*Eucalyptus eugenioides*); tea-tree (*Melaleuca spp.*); dogwood (? *Jacksonia scoparia*).

Forester Deverell, Glen Innes.—Easiest: Not stated. Most difficult: Narrow-leaf ironbark (*Eucalyptus crebra*); bimbil box (*Eucalyptus populifolia*).

Forester Siddins, Armidale.—Easiest: Red gum (*Eucalyptus tereticornis*); white gum (*Eucalyptus pauciflora*); red peppermint (*Eucalyptus sp.*); white peppermint (*Eucalyptus acmenoides?*); apple-tree (*Eucalyptus stuartiana*); honeysuckle (*Banksia integrifolia*); stringybark (*Eucalyptus macrorrhyncha*) below the Eastern Falls; bloodwood (*Eucalyptus corymbosa*); ironbark (*Eucalyptus crebra, &c.*) Most difficult: Stringybark (*Eucalyptus macrorrhyncha*) on the table-land; white box (*Eucalyptus hemiphloia*); yellow box (*Eucalyptus melliodora*); black sally (*Eucalyptus stellulata*); narrow-leaf peppermint (*Eucalyptus piperita?*); and nearly all young timber of the above-named sorts.

Forester Kingsford, Gunnedah.—Easiest: Apple-tree (*Angophora subvelutina*). Most difficult: Gums (*Eucalyptus*, smooth-barked species); forest oak (*Casuarina torulosa*).

Forester Mariott, Mudgee.—Easiest: Apple-tree (*Eucalyptus stuartiana*) and gum fully grown, and mature timber, and all pipy and stunted growths are easily destroyed. Most difficult: Box-trees of all kinds (*Eucalyptus hemiphloia, melliodora, &c.*), and young trees full of life; saplings and trees that have suckered are the reverse.

DRY PLAIN COUNTRY MAINLY.

Forester McGee, Narrabri.—Most easily: Pine *(Frenela endlicheri* and *robusta)*; oak and belar* (*Casuarina*); ironbark (*Eucalyptus crebra*); box (*Eucalyptus hemiphloia*). Most difficult: Gum of all kinds (*Eucalyptus*, smooth-barked); bibble box (*Eucalyptus populifolia*); budda (*Eremophila Mitchelli*); brigalow (*Acacia harpophylla*); swamp box (*Eucalyptus largiflorens?*).

Forester King, Coonamble.—Easiest: Pine (*Frenela endlicheri* and *robusta*); bull oak (*Casuarina glauca?*); belar (*Casuarina glauca*); yarran (*Acacia homalophylla*); wilga (*Geijera parviflora*). Most difficult: White box (*Eucalyptus hemiphloia*); yellow box (*Eucalyptus melliodora*); blue gum (*Eucalyptus viminalis?*); red gum (*Eucalyptus rostrata*); ironbark (*Eucalyptus sideroxylon*); apple-tree (*Eucalyptus stuartiana?*); budda (*Eremophila mitchelli*).

Forester Martin, late of Dubbo.—Easiest: Coolybar (*Eucalyptus microtheca*); belar (*Casuarina glauca*): bimble (*Eucalyptus populifolia*); pine (*Frenela endlicheri* and *robusta*). Most difficult: budda (*Eremophila mitchelli*).

Forester Kidston, Condobolin.—Easiest: Pine (*Frenela endlicheri* and *robusta*); bull oak and belar (*Casuarina glauca, &c.*). Most difficult: Box of all kinds (*Eucalyptus hemiphloia, melliodora, microtheca, largiflorens, &c.*).

Assistant-Forester Postlethwaite, Grenfell.—Easiest: Pine (*Frenela endlicheri* and *robusta*); belah (*Casuarina*); yarran (*Acacia homalophylla*). These never put out suckers. Bull oak (*Casuarina*) very seldom, and if suckers do sprout they soon die. Then ironbark (*Eucalyptus sideroxylon*); white box (*Eucalyptus hemiphloia*); apple (*Eucalyptus stuartiana?*); stringybark (*Eucalyptus macrorrhyncha*); yellow box (*Eucalyptus melliodora*); red gum (*Eucalyptus rostrata*) in the order named. Ironbark (*Eucalyptus sideroxylon*) in the Burrowa and Frogmore districts puts out very few suckers, but in the Grenfell, Temora, and Cootamundra districts this is reversed, and suckers grow plentifully. I cannot assign a reason for this, except that it may be that the former places have a cooler climate than the latter.

Forester Taylor, Wagga Wagga.—Easiest: All the pine family (*Frenela robusta* and *endlicheri*), as they do not sucker, if cut below the bottom limb. All the oak or belah family (*Casuarina glauca, &c.*), as they do not sucker freely, and then the stock eat them off before they have time to grow to any size. Nearly all the myall family (*Acacia pendula, &c.*) They are sapless, both root and branch, and will not sucker. Flooded gum (*Eucalyptus rostrata*), it suckers, but not to any great extent. Ironbark *Eucalyptus sideroxylon*), suckers, but not freely. Messmate *Eucalyptus amygdalina, var.*), is hardest of all to destroy; it suckers very freely, both from the trunk above ground, as well as from the knots near the surface, on the roots, right to their extremities. All the box family:—White box (*Eucalyptus hemiphloia, var.*); red box (*Eucalyptus polyanthema*); blue or grey box (*Eucalyptus hemiphloia*); bimbil (*Eucalyptus populifolia*), and especially

* At present it will be sufficient to refer to oak, bull oak, and belar as *Casuarina*, without defining the species, in instances in which botanical material has not been sent for that purpose. Most of the trees known as bull oak are *Casuarina glauca*; at the same time the name sometimes includes *C. equisetifolia* var. *incana*. Again, belar is often a fine-leaved form of *C. glauca*; but it sometimes includes *C. Cunninghamiana*, *C. equisetifolia*, and *C. lepidophloia*. Cones and twigs of the various trees known as bull oak and belar in different parts of the Colony would be acceptable, for the nomenclature could be readily settled if the necessary material were available.

yellow (*Eucalyptus melliodora*). These are hard to destroy by ringbarking. They all sucker freely, and if allowed to remain for three or four years the grass becomes less every year, and the end is far worse than the commencement. White-ribbon gum (*Eucalyptus viminalis?*); cabbage gum (*Eucalyptus pauciflora*); black sally (*Eucalyptus stellulata?*); all sucker freely, but are much easier got rid of than the box family.

Murrumbidgee and Murray.

Inspecting-Forester Manton, Moama. Easiest: Brush or scrub trees—conifers (*Frenela robusta* and *endlicheri*); casuarineæ (*Casuarina spp.*) Most difficult: Eucalypts—red gum (*E. rostrata*); white box (*E. hemiphloia*, *&c.*).

Forester Condell, Narrandera.—Easiest: Pine (*Frenela endlicheri* and *robusta*); yarran (*Acacia homalophylla*); boree (*Acacia pendula*). Most difficult: Box of different sorts (*Eucalyptus hemiphloia*, *melliodora*, *&c.*); oaks, various (*Casuarina spp.*); wattles, various (*Acacia spp.*). These timbers are very difficult to destroy, as they are constantly throwing out shoots if not rung at the proper season.

Forester Wilshire, Deniliquin.—Easiest: Murray pine (*Frenela robusta*); belar, or oak (*Casuarina glauca?*). Most difficult: Red gum (*Eucalyptus rostrata*); flooded or black box (*Eucalyptus hemiphloia*).

Forester Guilfoyle, Moama.—Easiest: With regard to the Murray pine (*Frenela robusta*), it hardly matters at what season of the year it is operated upon, because, like all species of the cypress tribe, it exudes gum or resin when cut into, and is therefore easily killed.

Forester Payten, Corowa.—Easiest: Pine (*Frenela robusta*); oak (*Casuarina*); box (*Eucalyptus hemiphloia*); the pine especially, as this timber does not throw out any suckers. Most difficult: Red gum (*Eucalyptus rostrata*).

The foregoing information is tabulated herewith:—

Eucalypts.—*Easiest.*

Common Name.	Botanical Name.		Number of Votes.
Gum*	Eucalyptus sp.		3
Blue gum	,,	saligna	9
Flooded gum...	,,	,, ...	
Grey gum	,,	,, var.	
Grey or red gum	,,	tereticornis	6
Red or flooded gum...	,,	rostrata	3
White gum	,,	pauciflora	3
Stinking or broad-leaf gum ...	,,	... ...	2
Box, white or grey box	,,	hemiphloia	10
Yellow box	,,	melliodora	2
Bimble box	,,	populifolia	2
Coolybar	,,	microtheca	2
Red or forest mahogany	,,	resinifera	4
White mahogany and stringybark	,,	acmenoides	3
White peppermint	,,	,, ...	2
Red peppermint	,,	... ...	2
Apple...	,,	stuartiana	5
Bloodwood	,,	corymbosa	4
Tallow-wood...	,,	microcorys	4
Blackbutt	,,	pilularis	3
Stringybarks	,,	eugenioides and macrorrhyncha	7
Ironbarks	,,	paniculata and others	13

* The name gum is generally applied to the smooth barked species of Eucalyptus.

EUCALYPTS.—*Most difficult.*

Common Name.	Botanical Name.	Number of Votes.
Box	Eucalyptus sp.	3
Box, white or grey box	,, hemiphloia	9
Yellow box	,, melliodora	5
Red box	,, polyanthema	3
Bible or bimble box	,, populifolia	3
Swamp box	,, largiflorens	1
Flooded or black box	,, ,, and hemiphloia ...	2
Black box*	,, longifolia...	1
Mahogany	,, resinifera...	1
Bangallay or bastard mahogany ...	,, botryoides	1
Apple...	,, stuartiana	1
Bloodwood	,, corymbosa	1
Tallow-wood...	,, microcorys	1
Gum	,, species	2
Blue gum	,, saligna	
Flooded gum...	,, ,, ...	5
Grey gum	,, ,, ...	
,, ...	,, tereticornis	3
Red gum...	,, ,, ...	
,, ...	,, rostrata	4
White-ribbon gum	,, hæmastoma (?)	1
Cabbage gum	,, pauciflora	1
Blue gum or white gum	,, viminalis...	2
Spotted gum...	,, maculata...	4
Broad leaf or stinking gum ...	,, ...	1
Peppermint	,, piperita	2
Narrow-leaf peppermint	,, ,, ...	1
Peppermint or messmate	,, amygdalina var....	2
Blackbutt	,, pilularis	2
Stringybark	,, eugenioides and macrorrhyncha, &c.	5
Black sally	,, stellulata...	2
Ironbark	,, crebra and sideroxylon ...	2

* Usually known as woollybutt.

Easiest, by a large majority: Blue gum, flooded gum (*Eucalyptus saligna*), grey and red gum (*Eucalyptus tereticornis*), mahogany of sorts, apple (*Eucalyptus stuartiana*), bloodwood, tallow-wood, stringybarks, ironbarks.

Practically equal division of opinion: Red or flooded gum (*Eucalyptus rostrata*), white and cabbage gum, peppermint, blackbutt.

Most difficult (by a large majority): Box of all kinds.

Most difficult (unanimous opinion): Spotted gum, black sally.

NON-EUCALYPTS—*Easiest.*

Common Name.	Botanical Name.	Number of Votes.
Apple-tree	Angophora subvelutina	5
,, ...	,, lanceolata	2
Turpentine	Syncarpia laurifolia	3
Red or scrub box	Tristania conferta	2
Oaks in general	Casuarina species	4
Belar or bull oak	,, glauca, &c.	13
River oak	,, Cunninghamiana	2
Forest oak	,, torulosa and suberosa	3
Yarran	Acacia homalophylla...	4
Myall	,, pendula	4
Pine	Frenela endlicheri and robusta	12
Wilga	Geijera parviflora	2
Honeysuckle...	Banksia integrifolia	2

NON-EUCALYPTS—*Most difficult.*

Common Name.	Botanical Name.	Number of Votes.
Tea-trees	Melaleuca	3
Brush or white-box...	Tristania conferta	2
Oaks	Casuarina	1
Forest oak	,, torulosa	2
Forest swamp oak	,, glauca	1
Coast swamp oak	,, stricta	1
Wattles	Acacia	1
Brigalow	,, harpophylla	1
Budda	Eremophila mitchelli	3
Black-bean	Castanospermum australe	1
Fig	Ficus rubiginosa.........	1
Kurrajong	Sterculia diversifolia	1
Stinging-tree...	Laportea	1
Dogwood	Jacksonia scoparia	1
Native ebony	....	1

SUMMARY.

Easiest (*unanimous opinion*) :—Apple (*Angophora*), turpentine, yarran, myall, pine, wilga, honeysuckle.

By large majority :—Oaks (*Casuarina*).

Most difficult (*unanimous opinion*) :—Tea-trees, budda.

Equal division of opinion :—Brush box.

NOTE.—Timbers receiving less than two votes have not been referred to in the summary.

4. Whether you consider trees should be sapped or simply ringbarked.

It will be seen that the opinions in favour of sapping and ringbarking are practically identical. The actual numbers are :—

In favour of sapping	15
In favour of ringbarking	15
Those who are uncertain, or who give uncertain replies	3
Total	33

Nor are the foresters in practically the same climatic districts unanimous as to the best methods of destroying trees. We must, therefore, wait for further evidence on the subject.

I have tabulated the most obvious advantages and disadvantages of the two methods of destroying tree-life, though, doubtless, other items might be added.

Saplings should either be rooted up or denuded of their bark, but never chopped down, as that, or careless ringing, will invariably produce an abundant growth of suckers, as pointed out by Forester Macdonald. Most of the foresters' replies to this question will be found to convey useful information.

Ringbarking—Advantages.

1. Comparative immunity from suckers.

Ringbarking—Disadvantages.

1. Length of time in killing the tree.
2. Not effective with all trees.
3. More or less uncertainty, as a strip of undisturbed bark, inadvertently left, may be sufficient to continue the life of the tree.

Sapping—Advantages.

1. Rapidity of death of tree.
2. Grass comes sooner.

Sapping—Disadvantages.

1. Liability to suckers.
2. When the trees are hollow there is increased danger of their falling.
3. Greater crop of seedlings.
4. Often covers the ground with leaves and twigs.

North Coast.

Forester Pope, Murwillumbah.—If the trees are simply ringbarked they will take longer to die, but the probability is that no suckers will follow, or only a few, whereas, if sapped, they die immediately—in a few weeks, or, if the weather is dry, in a few days. But another evil appears in the shape of thousands of suckers, which spring from the stump below the ring, and also from the roots and seeds, caused, I presume, by the more sudden check, and the vitality of the sap still left below having to find an outlet somewhere. The seeds, also, which have fallen come up more readily if the trees are killed quickly, whereas, in the former case, with the more gradual withering, the seeds are not so much exposed to the sun, and appear to rot with the fallen leaves and twigs. Ringbarking is carried out in forest country alone. I have seen it tried on scrub trees, but without effect. The bark will again grow, and in a year or two cover the wounds.

Forester Huxham, Grafton.—Trees should be sapped.

Forester Mecham, Bellingen.—In my opinion, sapping is most effective, killing the timber very much quicker, and not so likely to sucker. The great difficulty in the North Coast districts is to keep the undergrowth down, and I think that by sapping at the right time of the year a lot of that can be prevented. From my observations the hardest class of country to deal with in the North Coast districts in the destruction of the timber is that known as scrubby forest country, where there is a mixture of all timbers, the country generally being very moist, being at the base of the ridges and along the small creeks.

Forester Macdonald, Kempsey.—The best and most economical method of ringbarking big trees is to simply make a single chop circle round the tree, with a downward pressure of the axe, before withdrawing it, after each cut. This method of a single-cut ring, through bark and sap, makes a good receptacle for the retention of the rainwater, which causes speedy decay of the bark and sapwood so cut, and consequently prevents the formation of new bark, and the growth of suckers from the stump. Saplings should either be taken up by the roots, or simply denuded of their bark, but never chopped down, as that or a careless ringing will invariably produce an abundant growth of suckers.

Forester Brown, Port Macquarie.—I consider sapping is the most effective, if done by cutting through the sapwood, all round, and giving the axe a

wrench outwards before removing it, so that the top of the chop will be clear, with a space in which the rain will lodge, to decay the wood and bark. I also consider that the formation of the country (ridges or flats, &c.), combined with the quality and description of soil, has a great deal to do with the effect of ringbarking on the trees, as to the quantity of suckers, and the length of time the timber is in dying; and that the position of the land, whether facing the sun or not, may make a material difference.

J. M'Lennan, Yarras.—Ringbarking favoured. If ringbarked 3 inches wide, and ½ inch deep, they will die quickly, and not throw up suckers; sapping not needed.

A. Kennedy.—I find that ringbarking does best on open ridges, about 30 or more miles from the coast, and is most difficult to manage on low flat land and near the coast. I find the best method to ring* is to chop with the axe slanting downwards, giving the wood under the bark a jagged surface; if this is done at least, ⅛ of an inch deep, and continued right round the tree, one ring is sufficient and effective on any timber.

J. Downes, Rawdon Island, Port Macquarie District.—I have tried ringbarking in two ways—viz., single chop, and double chop; I find out that the single chop is the best, by wrenching the bark and sap out when releasing the axe. The single chop has many advantages over the double chop, not only is it cheaper, but more effective. There is not so much suckering in single as in double chop, the reason being that, the rain water runs down the tree into the cut, which is half perpendicular and rots the sap and kills the tree above and below the ringing. The double chop is done by chopping a ring round the tree in two chops, top and bottom about 2 inches wide. The top chop is half perpendicular, while the bottom one is horizontal, thus liberating the chip. The horizontal or bottom chop does not disturb the bark, and rain cannot get at the sap, and only kills the tree above the ring. I prefer single chop ringing to sapping.

Forester Rudder, Booral.—The hard-killing trees should, I think, be sapped. Trees sapped often die in a week or two, while ringbarked trees may survive over a year. I am inclined to think that the latter, when the trees die are the least inclined to sucker. Ringbarking will not kill Swamp Oaks.

Central Coast.

Forester Cobcroft, Singleton.—Ringbarking.

Forester Martin, Gosford.—Ringbarking; a girdle of bark a foot wide, leaving the sap wood clean and bare. Sapping gives the quickest result, but is often attended with suckers, and when the trees are hollow, will cause them to fall. The country suitable for ringbarking is open forest without undergrowth, timbered with box, apple-tree, coolybar, &c. Country thickly timbered with belar is expensive to manipulate, but gives good results; but from scrubby country with poor soil, and timbered principally with ironbark or stringy-bark, poor results may be expected. The following trees should not be ringbarked, as their leaves are eaten by stock in hard times: Myall, yarran, supple jack, leopard-tree, rosewood, mulga, colaine, kurrajong, and quandong.

Forester Stopford, Penrith.—I am of opinion that sapping is a far more certain way of destroying timber of any kind than simply ringbarking.

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* Sap.

[Note.—The concluding portion refers to Mr. Martin's experience in the western districts.]

South Table-land and South Coast.

Forester Rotton, Picton.—One is as effective as the other, if done carefully at the proper season, but I consider sapping preferable, inasmuch as it kills the timber very much quicker, and the grass comes much sooner. Ringbarking, if possible, should be done in rainy weather, as the bark is then more easily removed, and it should be done most carefully, for if the least piece of bark, either inner or outer, be left, the tree will live. In July, 1886, I remember seeing some flooded gum-trees at Cox's River, which had been ringbarked in June, 1885, and they were still alive, and had no appearance of dying. I noticed that a small portion of the inner bark had been left, and was growing sufficiently to keep the tree alive.

Forester Allan, Milton.—From my own observation, I am inclined to favour ringbarking as against sapping; I have watched both processes. No doubt sapping is very effective, and kills the tree at once, but it covers the ground with *debris*, and the roots keep green for a few years throw out shoots, and seedlings spring up all round. I may inform you that there is a great diversity of opinion amongst settlers as to the best mode of killing trees. Many favour sapping; others ringbarking.

Forester Benson, Bega.—The methods of killing trees are:—(*a*) By cutting through the bark and sap of a tree at a convenient height for the axeman; this is called sapping; (*b*) Taking a belt of bark from round the tree, about 16 inches wide; (*c*) Cutting through the bark, about 2 feet from the ground, and then stripping the bark down to the ground with the hand. The last two are considered the best methods, as while the trees take longer to die they throw no suckers. Suckers are not the only thing to be considered after ringing has been completed (sapping is probably referred to.—J.H.M.) seedlings will spring up as soon as the timber is killed, and must be looked for and despatched when they are well up. Thousands of pounds are wasted in this district through not attending to the destruction of seedlings, which spring up after the forest timber has been killed, making the land more difficult and costly to clear than it was before any ringing was done. The grass is more plentiful when the trees are ringbarked, and becomes sweeter and more nutritious for stock, and is consequently better for fattening and dairying purposes.

Forester Harris, Queanbeyan.—I consider trees may be simply ringbarked if done at the proper time of year, but the bark should be rung to a width of 9 or 10 inches. If this is done I am of opinion that ringing is far better than sapping.

North Table-land.

Forester Crowley, Casino.—Timber rung in dry seasons dies off much better than if rung in wet ones.

Forester Deverell, Glen Innes.—I think it is quite immaterial whether the trees are ringed or sapped providing they are done at the proper time, but I think if anything ringing is the best and most to be preferred, because it is more effectual in the long run (with the exception of gums, which should be certainly sapped). The branches when dead stand up much longer, though, no doubt, it takes a tree much longer to die when only ringed; but generally it is considered best, as the branches do not fall so early and thus encumber the ground, while when sapped the trees die much quicker, and is, in most cases, just as effective, only that the top branches fall very much quicker. Ringbarking or sapping imperfectly done and not attended to afterwards has the effect of increasing the number of the saplings tenfold, and encourages a growth of timber that cannot be matured; therefore, as this growth only

harbours rabbits and other noxious animals, people so offending ought to be made do it properly. If trees are ringed or sapped at the proper time, and then follows a dry season, it will be found very effective, much more so than if the following be a wet one.

Forester Siddins, Armidale.—I consider that sapping is more effective than ringbarking. The latter can only be done when the bark strips clean, that is, leaving no parts adhering to the sapwood. If it does, the bark will grow over the wound and the tree live. With sapping this danger does not exist, for, if properly done, circulation is completely cut off and cannot be restored. This has been my experience since the year 1862. I may mention that I have found it a mistake to cut too deep into the wood. The thickness of an eggshell of the sapwood being disturbed or removed is quite sufficient to destroy the tree, and suckers are not so likely to be produced. When managing men on whom dependence could be placed, I allowed only one cut around the tree, each blow entering part of the previous one, the wrist being slightly turned, caused the sapwood and bark to open out, forming round the barrel a sort of cut, into which the water collected during rain continually, decomposing the bottom of the wound and preventing suckers from growing. Killing the timber very frequently induces large numbers of seedlings to spring up, the only way to deal with which is to grub them up when they are about 2 feet high.

Forester Kingsford, Lismore.—The practice of ringbarking in this district is carried on to a very limited extent only, its operations being confined almost entirely to some small areas in the western portion, the remainder of the district being characterised by a growth of scrub wood more or less dense. Clearing is done in a face, it being customary to fell everything which comes in the axeman's way during the winter months in order to allow the timber time to dry sufficiently for firing in the summer. In so far as the scrub trees are concerned, I believe they would, in a majority of cases, be easily destroyed by ringbarking; those hardest to kili—black bean, native ebony, &c.—being very useful timbers.

Forester Marriott, Mudgee.—I am of opinion trees should not be sapped, as by so doing the sap is simply driven back to be thrown up elsewhere. In ringbarking, a strip of about 9 inches wide without touching the sap will allow all the sap circulating by means of the sapwood to slowly exude from the tree through the incision, instead of passing in its natural course to the roots, thus slowly and effectually killing the trees.

Dry Plain Country Mainly.

Forester M'Gee, Narrabri.—I consider that trees sapped are more surely killed than if ringbarked, they also die quicker. I am in favour of sapping, although both, at times, prove equally effective. A great deal depends upon the season; if a very dry season, the tree is generally easy to kill, and *vice versa.* Timber growing upon low or swampy country is harder to kill and destroy than timber on hilly or undulating country.

Forester King, Coonamble.—I consider that it is better to sap than simply ring, for the following reasons, viz:—First, if the season is wet, and the timber young and healthy, great care is necessary in the operation of ringing, or else half the trees will not die. Secondly, when timber has been sapped, the trees invariably die within twelve months, and, therefore, the roots decay quickly, so that, if the land should at any future time be required for agricultural purposes, the process of preparing the soil for the plough could be performed at a much cheaper rate, as timber trees only ringbarked retain

their vigour longer, and toughen the roots. It is the opinion of many that sapped timbers die soon, and the lighter limbs fall off, and thus encumber the ground, whereas those ringbarked take longer to die, and the tree toughens, and what falls off acts as a good manure; but there is no doubt that timber such as budda should not be sapped, as the timber grows thicker than ever. I have seen budda timber that has been felled, and the country is thicker with the trees than it was before an axe was put into it.

Forester Kidston, Condobolin.—In answer to this question, to which I have given much attention, I am certain that the locality in which timber is growing has much to do with the growth of suckers after ringing. Box timber ringed to the "red," or permanent wood, on the level flats near the river (Lachlan) seldom throws suckers; slightly ringed, on the same flats, suckers are certain. The very same kind of box growing on rolling upland country, and rung to the "red" or "sudden death," as it is called, invariably throws suckers abundantly.

Assistant-Forester Postlethwaite, Grenfell.—I think trees should be simply ringbarked—that is, a foot, or at least, 8 inches, of bark should be stripped off. This will prolong the life of the tree to about two years, but in dying gradually the sap dies with it, and fewer suckers are the result, as a certain amount of sap will rise through the alburnum to the upper bark, whereas, if sapped, the sap gets a sudden check, and will sprout with greater vigour. Saplings are more difficult to manage than mature trees; if very small, say up to 3 inches in diameter, they cannot be rung, but are generally cut down, and then suckers spring up without fail. I do not approve of saplings of this size being interfered with, for I know of no remedy against suckers, for, if they are cut off, they will only put out again lower down till they come from the butt; in that case grubbing is the only plan. In ringbarking, every cut of the axe should be downwards, and, while making the lower cut, the handle should be pressed outwards each blow, so as to loosen the bark, and being cut as stated, will form a sort of cavity or cap to hold the water (rain) that runs down the trunk, and thus helps to cause decay. April is the best month for cutting suckers. I cannot give the reason, but this is what I have found to be the case. If suckers are left too long before they are destroyed, and too large to split off the stump, the tree should be ringbarked again below the suckers; this will prevent the ground being covered with dead sticks.

Forester Taylor, Wagga Wagga.—By all means sapped, in either of the two ways, namely, cutting with an up and down stroke, taking the piece clean out to the heart-wood, or else two deep frill rings 4 inches apart. Down-stroke clean to the heart-wood overlapping each cut, so as to leave no sapwood that is not severed, then an outward pressure with the axe handle.

The difference between the two methods speak for themselves. First, the clean up and down cut leaves no lodgment for the rain water, while the frill-cut leaves a cup or basin around the base of the tree which retains all the rain water that runs down the tree, thereby causing the bark in a great measure to rot and peel off, which prevents the growth of suckers considerably.

The taking off a foot of bark, which is termed ringbarking, without it is done just when the sap is in full flow, is next to useless on many kinds of timbers, notably the red gum, yellow box, messmate, &c., and the fine fibres or threads of bark which are left adhering to the tree very soon unite and then form a thin covering of new bark, so that when large blocks of land are to be operated upon it is impossible to ring all the timber during this

time that the sap is flowing freely; further, over every 20 miles of country the season varies, and in some districts where the rainfall is small and uncertain the sap rises with the autumn rains freer than it does with the spring rains.

Murrumbidgee and Murray.

Inspecting Forester Manton, Moama.—The question of ringbarking timber upon Crown lands, I think, should be considered under two heads: First, the destruction of the natural forests by the process of ringbarking with the object of rendering the soil more suitable for pastoral purposes by increasing the production of grass; secondly, ringbarking the useless trees with a view of improving the condition and growth of others.

I am utterly opposed to the system of destroying the natural forests in the extensive manner that it is being carried on in this district, as the extent of untimbered country is very large, and fully as much timber has already been destroyed by ringbarking as I deem advisable on Crown lands, especially when the large alienations of land that have already and are taking place, is taken into consideration, as the alienation of land virtually means the total destruction of the timber. In the course of a short time, on nearly all the alienated land the timber will be destroyed, and the population will be thrown entirely upon Crown lands for their future supply of timber for railways, bridges, fencing, building, and even fuel.

The destruction of the forests of this district has been carried on at an unprecedented rate, and I cannot but think that in the not very distant future, when this district shall become populated, that the wasteful destruction of its timber will be looked upon as a national calamity.

Under the circumstances above stated I would certainly recommend that no future permissions should be given to ringbark timber upon Crown lands in this district. I think that no objection should be raised to the destruction, under proper supervision, of pine scrub, mallee, and other useless scrubs.

With reference to ringbarking the useless trees and thinning the saplings with the object of improving the condition and growth of others, I think that ringbarking with this object could not be judiciously entrusted to the pastoral lessee of the land to carry out.

Forester Condell, Narrandera.—My experience is that simply ringbarking is the most effective, as I find that trees sapped, although killed more suddenly, are much more liable to throw out shoots. Timber ringbarked during the months specified, although it takes longer to die, seldom throws out any shoots.

Forester Wilshire, Deniliquin.—By simply ringbarking you take longer to destroy the tree, but you gradually exhaust the sap, and this prevents a growth of suckers, and it hardens the wood and prevents it falling on the ground for many years. Red gum requires to be well sapped, otherwise the sap runs and forms a new bark. When an old gum-tree is destroyed, hundreds of seedlings at once grow, and it would be an immense advantage if all the old useless gum-trees were destroyed on all the forest reserves in this district, as seedlings would take their place by thousands, and they could then be thinned when at a proper stage of growth.

Forester Guilfoyle, Moama.—I have long been convinced that the safest and best process is ringbarking. The trees may take longer to die, it is true, but then they die to the roots. On the other hand, *re* "sapping," it is, in my opinion, a far more elaborate and tedious process, and, in dealing with a large area, would prove to be most expensive and less effective. I have, in the course of my experience, extending over many years, observed scores of

instances of trees actually recovering themselves after having been "sapped" or "gapped" by the downward cut. Suckers and shoots, too, have been more numerous in the case of box-trees when treated in this way. In the system of ringbarking, should sprouts or shoots or suckers appear, a thing which is sure to occur no matter which system is adopted, they should be knocked or "scalped" off (not cut) when a foot or so in length. To merely cut these shoots is to make them grow the stronger and give endless trouble, because the operation has to be repeated over and over again, like the pruning of a fruit-tree. Of course it may be necessary, in nine cases out of ten, to repeat the so-called "scalping," but then there is the satisfaction of knowing that the death of the tree is a certainty. I do not think it is ever wise to cut far into the sapwood or cambium layer. Either one method or the other should be strictly adhered to. The bark should be stripped to (say) a foot in width.

Forester Payten, Corowa.—To effectually destroy trees the sapwood should be cut through, and all cuts with the axe made downwards.

Also, any other information that may be useful to the Department, especially the effect of ringbarking in the grasses.

The replies to this question are very unanimous, several of them interesting, and will repay thoughtful perusal. There can be no doubt that the effect of depriving the trees of life, whether by ringbarking or sapping, is to increase the quantity and to improve the quality of the grasses, and Mr. Siddins gives a specific instance of improved grass value in the Hunter River district. The improvement is unmistakable, but Mr. Martin points out that (in his opinion, at least) this is not lasting, stating that after about four years it will gradually decrease, but the quantity of grass will always be equal, if not more than equal, to that under live trees.

At the same time, indiscriminate ringbarking is a great mistake. Some shelter is always required for stock, and some thought requires to be exercised as to the best trees and best situations for shade and wind-breaks.

Some foresters go into the effect of ringbarking on the flow of water in natural watercourses, three who refer to this matter specifically stating that it increases the flow of water, while a fourth inclines to an opposite view. There is quite a voluminous literature on this subject already, and we hope to discuss it in the pages of the *Gazette* at some future date.

Forester Pope, Murwillumbah.—The effects of ringbarking are in every case beneficial, both to the land and the grasses, especially to the latter. Grass will, as a rule, begin to grow as soon as the trees die, in places where no grass ever grew before, and the quality is always improved. The grasses are usually coarse and sour when the timber is among them. "Blady" grass, which is of no use whatever, as horses and cattle will not eat it, disappears altogether in two or three years after ringbarking.

Forester Huxham, Grafton.—Ringbarking generally increases the growth and improves the nature of grasses; it also increases the flow of water.

Forester Mecham, Bellingen.—There is no doubt as to the benefit derived, both in increasing the growth and sweetening the grasses.

Forester Macdonald, Kempsey.—Doubtless the grazing capacity of forest land may be materially improved both in quantity and quality of the grasses by ringbarking, but it should be remembered that an injudicious destruction of the forest may also materially injure the drought-resisting capabilities of

the land, as a certain provision for shelter appears necessary for both animal and vegetable life. The best grazing country I have seen, supporting stock in all seasons, is undulating country interspersed with belts and groups of timber.

Forester Brown, Port Macquarie.—Ringbarking or sapping timber appears to have a beneficial effect upon the grasses by improving and sweetening them, also by increasing the quantity. I consider wholesale ringbarking is not advisable, as I cannot think the good effect on the grass will be lasting; but think that killing all useless timber-trees so as to leave from twelve to eighteen trees on an average to each acre for shade and wind-breaks, would have a more lasting benefit on the grasses.

Angus Kennedy, Port Macquarie.—I find that ringbarking doubles the stock-carrying capabilities of land in these rivers where effectually done.

J. M'Lennan, Yarras.—All grasses grow stronger, and the good kinds become sweeter and better, the bad ones becomes more aggressive such as foxtail, sword tussock, and blady grasses on ridges and flats. Gullies wash out badly after ringbarking, and boggy or wet patches appear on the sides of the ridges, but the supply of water is more permanent after ringbarking. On my place I could not notice any difference, on ridges, or flats, or rich, or poor soil, only the white clover spreads with greater freedom now, and the rich ground throws off more wild and useless rubbish, and more good grass.

Forester Rudder, Booral.—The effect of ringbarking or sapping in a general way, especially on undulating and ridgy land, is greatly to improve the pasture, but not in all cases. On rich flats and gullies the timber should not, as a rule, be destroyed, as it induces a very rank growth of coarse tussocky grass of no value; in this way some of the richest of the land is made valueless. The undergrowth, *i.e.*, scrub and smaller trees, should be kept down; but large shady trees—not too thick on the ground—should be left, as they suck up redundant moisture, and help to keep down the coarse worthless grass.

Forester Cobcroft, Singleton.—Ringbarking always improves the land and grass.

Forester Martin, Gosford.—The general effect of ringbarking trees in suitable country, is to improve both the quality and quantity of the various grasses growing under and about them. The death of the tree gets rid of shade, and does not interfere with the action of the sun on the earth, and that which went to make up the life of the tree is retained in the earth, and is given to the various grasses, stimulating them to vigorous and increased growth; but this stimulation is not lasting, and after about four years will gradually decrease, but the quantity of grass will always be equal, if not more, than under live trees. Ample provision should be made for shade and shelter, by leaving belts of live timber. It may be of interest to inquire whether stock diseases have or have not increased since ringbarking.

Forester Stopford, Penrith.—The effect of ringbarking or sapping on the grasses is almost immediately noticeable, and in addition to supplying more nutriment to the grasses, and thereby increasing the growth, has also the effect of sweetening the herbage, and rendering it more palatable and beneficial to stock.

Forester Rotton, Picton.—There is no doubt that ringbarking or sapping has the effect of producing a much larger quantity of grass which is sweeter, and has quite three times the fattening qualities of grass on country not ringbarked, in fact, for either grazing or agricultural purposes, country not ringbarked is useless. It is said that ringbarking decreases the rainfall considerably, but in my district I have not found it so. However I have

frequently seen, in places where ringbarking has been done, springs appear in localities formerly dry, and sluggish springs run freely, giving a good supply of water.

Forester Allan, Milton.—The effect of ringbarking, or sapping, is very marked in the growth of the grasses; it becomes thicker, sweeter, and more fattening for stock. The Braidwood district is an example of what ringbarking and sapping have done for the improvement of grasses.

Forester Harris, Queanbeyan.—The effects of ringbarking on the grasses is very marked; it produces a more luxuriant growth, and at the same time a far hardier grass, whilst the ordinary kangaroo-grass growing in the district would be killed by the frost. This only applies to ground of good quality, or fairly so, but on strong barren country, ringbarking does not produce such good results, the grass apparently, after a year or two, dying away again. Ringbarking also has the effect of drying up the ground considerably, and I have noticed that where it has been carried out to any great extent, the rainfall is not nearly sc large as in more timbered country.

Forester Crowley, Casino.—Certainly ringbarking improves the country as far as grass is concerned; the grass is much better, and thicker, and has more substance. In flat country in this district, when the soil is much poorer, the carrying capabilities after being rung are three to one, and stock are kept in much better condition. Ringbarking indiscriminately is a great mistake, as stock want shelter in summer as well as winter.

Forester Deverell, Glen Innes.—There is no doubt, in my mind, that ringbarking properly carried out very considerably increases the grazing capabilities of the land; in fact, it not only improves the quality, and increases the quantity, but it makes the hitherto dry gullies run, and often contain permanent water. In ringed timber the grass springs much earlier, but, again, it dies off much quicker in dry weather. In conclusion, I think great care should be taken in reporting and inspecting on application for ringbarking, and I certainly should suggest that owners of conditional purchase leases should not be allowed to ringbark indiscriminately, as I have known cases where the above have been taken up simply to destroy the timber (it being the only timber in that part), so that it could not be used for building purposes, and thus the neighbouring land could not be taken up, as timber was too expensive. Again, it is a shame to see some places entirely denuded of their timbers, utterly regardless of value for shade, shelter, beauty, or market, by indiscriminate ringbarking.

Forester Siddins, Armidale.—The effect upon the grasses is to sweeten and increase them gradually. An entire change of kinds is produced; also artificial grasses are induced to grow without cultivation on the richer soils in this district, immediately after sapping has been done. White clover increases rapidly, and rye also spreads to a considerable extent. The benefit of the improved food to stock is remarkable. As an instance of the increased grazing and fattening results produced by sapping, I may be permitted to mention one case that came under my immediate notice. In the year 1860 the late Hon. James White purchased the Martindale Estate on the Hunter, for the purpose of breeding store cattle to supply his fattening stations, the herd at the time of purchase mustering about 1,800 head, which were feeding over about 40 square miles of country. Shortly after delivery being taken the property was fenced, and the stock confined to a very much smaller area. At this time it was very unusual to find a bullock fit for beef, and almost impossible to get one suitable for market, a few cows (not more than 100) being fit for that purpose in the year. In 1862, Mr. Thomas Hungerford commenced sapping, Mr. White following his example, which was

continued until the whole of the property was operated upon. The improvement in the grass was noticeable within six months of the operation being done, and continued up to the time of my leaving in 1876, the carrying capacity being then increased to over 3,000 head, and the average number of fat bullocks sold annually was 1,000, the quality of the cattle being superior to the bulk of stock landed in Sydney from Liverpool Plains or elsewhere.

Forester Kingsford, Gunnedah.—Beyond a doubt, ringbarking is the means of causing the better class of grasses to grow where formerly nothing but the coarse native grasses were found, besides sweetening the ground generally, but where carried on to too great an extent the grass is more liable to become injured in the event of frost.

Forester Marriott, Mudgee.—The grass of good country, with deep soil, is always improved by ringbarking, but on poor and shallow soils, grasses sheltered by the timber, stands longer, being liable to dry up quickly when exposed. On plains, likely to suffer from drought, timber should be preserved or only a judicious thinning out allowed.

Forester M'Gee, Narrabri.—The effect of ringbarking or sapping is most beneficial upon grasses of all kinds, causing a more abundant crop and a greater variety, the quality being superior in every way. I am not in favour of wholesale and indiscriminate ringbarking. Ringbarking or sapping in heavily timbered country causes the land to be moist, and retains moisture longer, and in some cases it produces surface springs of water, which are more or less permanent.

Forester King, Coonamble.—There is complete proof that the ringbarking of average timber considerably improves the grazing capabilities of the land, always taking into consideration that certain trees should be left for shade, shelter, &c.

Forester Kidston, Condobolin.—The effect of ringbarking on the grasses is immediate and unmistakable, the thicker the timber killed the greater the benefit, up to quadrupling or more the grazing capability.

Assistant Forester Postlethwaite, Grenfell.—Ringbarking will enhance the growth of all grasses, and I do not see much difference in the growth whether the timber is sapped or merely ringbarked. It also makes the herbage sweeter, and stock prefer it to grass grown in green timber; this I have proved, for I have seen a paddock, half only of which was ringbarked, and the sheep kept in the rung timber till the grass was quite exhausted before going into the green timber.

Forester Taylor, Wagga Wagga.—The effect of ringbarking upon the grasses is first to cause the wiry sapless grasses to die out, then the classes of new grasses are sweeter, quicker grown, denser, and more nutritious and lasting, caused by the effect of the sun and light drawing the moisture nearer the surface. It must be borne in mind that the aspect, altitude, and variations of climate all cause apparent effects upon ringbarked timber; also the westerly winds during the summer months.

Inspecting Forester Manton, Moama.—There is no doubt that ringbarking has a great effect in the more abundant production of grass.

Forester Condell, Narrandera.—The ringbarking of timber I find, from my experience, has a very great effect for good as regards the growing of the grass, as ringbarked country grows splendid crops of grass, whereas you will find the country in its natural state as regards timber alongside the ringbarked country without a vestige of grass on it.

Forester Wilshire, Deniliquin.—By ringbarking the grass does not come nearly so soon as by sapping. Most of the box timber in this district has

been sapped, and the pastoralists and selectors have now great difficulty in getting rid of the suckers and also the box seedlings in moist ground.

Forester Guilfoyle, Moama.—As regards ringbarking on the grasses, it is a fact that in some of the thickly timbered country of this district, after a successful ringbarking, and the trees have withered for (say) eighteen months or so, is a pleasure to look at places where a blade of grass could scarcely be visible heretofore, now clothed with a dense carpet of green. The grasses spring up like magic; in fact, as if sown by hand.

Forester Payten, Corowa.—Ringbarking has a wonderful effect upon grasses and herbage. I have noticed land prior to the trees having been ringed thereon that the roots of grass and herbage were very scant, but in about two years after the trees were destroyed the grass and herbage could have been mown.

Bibliography of Ringbarking.

Much valuable information on the above subject is contained in proceedings of societies, official reports, and in miscellaneous works. The botanist proposes to publish a brief bibliography of ringbarking in the pages of the *Gazette*, and readers are asked to kindly favour the Department with references to any publications on the subject.

Poultry.

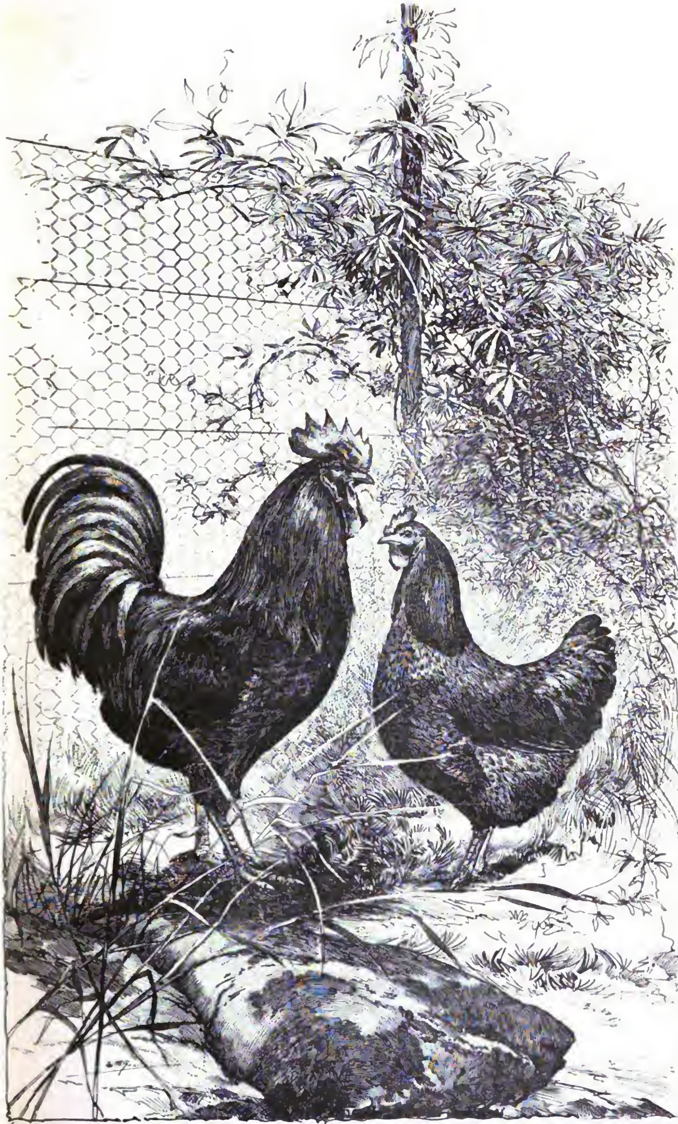
By S. GRAY,
Sub-Editor.

The Orpington.

The breed with which I propose to deal in the present article occupies in England a similarly unique position to the Australian game on this side of the equator, as being the only breed actually and successfully produced there. This is peculiarly remarkable from the fact that English fanciers have, almost without exception, been able to considerably improve any breed of fowl which has passed through their hands, even those originating in America, the home of the majority of new breeds. Without going into foreign matter, this fact appears to be very characteristic of the two peoples, and what, upon consideration, might have been expected from the "push" of Americans, as opposed to the deliberate and conservative nature of English people and—may I be permitted to add—of New South Welshmen.

It is also interesting to note that the objects which the originator had in view—hardiness and economic value—have undoubtedly been achieved. The originator, Mr. Cook, of Orpington House, St. Mary Cray, Kent, first crossed large Minorca cocks with black "sport" hens of the Plymouth Rock, and then bred selected pullets resulting from this cross with clean-legged Langshan cocks, fixing finally the desired characteristics by selection and the provision of unrelated strains. The result of these operations may be seen in the accompanying illustration, which was drawn specially for this article by Mr. E. M. Grosse, from two birds in the possession of Mr. J. E. Pemell, of Randwick, both of which have obtained "firsts" in Sydney and Melbourne.

The slight economic value attaching to the usual run of feather-legged birds first called my attention to the Orpington, as one which, while possessing all the handsome appearance of the Langshan, appeared to me more like the business bird. I, therefore, obtained a setting of eggs, which all hatched out, and I saved eleven hardy chicks in a very trying season. The youngsters were not the slightest trouble; they grew rapidly and feathered quickly. I thought at first that the amount of white they showed portended something wrong, but find that this is characteristic of the breed. I felt fairly satisfied as to their hardiness, but shortly afterwards had ample proof of it. I had occasion to change my place of residence, and owing to a variety of circumstances was unable to provide comfortable quarters for my birds during the whole of last winter. The Orpingtons went through rain, frost, and general discomfort without a sign of ill-health; in fact, they appeared rather to like it, and the pullets started to lay early in August. As they were not hatched out until the middle of the previous December, they were laying at 8½ months old, and when frosts where I reside are nothing like over.



ORPINGTONS.

Bearing these facts in mind, I determined to take an opportunity of getting Mr. Pemell's opinion regarding them, and while the picture was being drawn I had several opportunities of doing so. As is known, Mr. Pemell is an experienced breeder of many varieties, and speaking of the Orpington he considers it to be the best all round fowl he has ever kept. He holds a decidedly adverse opinion to the introduction of the rose comb, on the ground that this introduces a difficulty in breeding, which is outside the original intention. Mr. Cook admits that his object was to produce a self-coloured bird, with no point requiring any particular care in breeding, useful both as a layer and a table bird. These qualifications, Mr. Pemell contends, exist to the full in the single-combed bird, and therefore the rosecomb is an unnecessary and detrimental innovation. In this opinion I cordially agree with him. Unless a rosecomb is almost perfect it is anything but pretty, while the neat single comb appears to me to be exactly suited to the general style of the bird. It is often remarked by the Langshan breeder that the Orpington is only a clean-legged Langshan, to which I reply that to that extent it is an improvement, as there is to me no particular beauty in a few straggling and usually dirty feathers on a bird's legs or feet.

The particular claims of the Orpington are that it combines the good-laying qualities of the Minorca—the eggs, however, being brown-tinted—with the weight of flesh common to the Plymouth Rock, added to which the whole black feathering makes it an easy bird to breed. They have a white skin and flesh, the latter being very fine, and tasting much the same as that of the Dorking; feather and grow faster during the first six weeks, and are easier to breed true to colour than the Plymouth Rock; lay rather more eggs; are not so liable to become fat internally; and are not such persistent sitters as Rocks. My experience of them in this country leads me to admit all these claims, with the reservation that I have not found the Plymouth Rock a "persistent" sitter. I must not omit to add that the Orpington appears equally contented and healthy whether in freedom or confinement, in town or country. I have not sufficient personal experience to compare it with the Langshan as a winter layer, but am informed that it runs its feather-legged rival pretty closely in this respect, and there is little or nothing to choose between them on the table. Under all the circumstances, I feel perfectly safe in recommending the Orpington as a very desirable fowl to keep.

To enable would-be purchasers to select the right thing, I give Mr. Cook's description :—"The plumage should be very glossy in both sexes, but more particularly in the cock. The sheen should be much the same colour as a good Langshan; single combs, evenly serrated in both sexes, standing erect in the cock, not large, but neat; red face and ear-lobes; black or dark legs, not too long; white toe-nails, four toes on each foot, well spread out from each other. The hen's comb may fall a little to one side if it is evenly serrated, and without folds in it." The cocks weigh from 9 to 12 lb., and the hens 6 to 8 lb.

In addition to Mr. Pemell, I find the following breeders of Orpingtons in New South Wales:—Mrs. R. Graham, Five Dock; Mrs. W. H. Webb, Bathurst; Mr. P. S. Grunsell, Goulburn; Mr. T. Hall, Fairfield; Mr. C. Penrose, North Willoughby; Mr. L. L. Ramsay, Five Dock.

Practical Vegetable Growing.

Directions for the Month of February.

The month of February is generally exceedingly hot all over the Colony, and unless good showers of rain occur the growing of vegetables is a somewhat difficult matter where good supplies of water cannot easily be obtained. However, frequent cultivation in stirring the surface soil will work wonders. At first sight it seems perfectly absurd to keep hoeing away on soil that is almost dust, in the hope of preventing evaporation, but anyone who will really think and reflect, and make experiments, will find the frequent, almost daily, stirring up the surface soil will have the same effect as a mulch. It should not be difficult on any farm to collect an excellent supply of the droppings of cows and horses, which can be used as a thick mulch. If the cow-dung be spread in big lumps some of it will become as hard almost as stone. This is not desirable, for, although it will act admirably as a mulch, it would not be advisable to dig it into the ground after it has served its purpose as a mulch. If water is abundant a good supply of vegetables can be raised. It is not the best practice to over-water, for then the vegetables are not as good as if the water were supplied judiciously, chiefly in the shape of liquid manure. In places where water is scarce it would be desirable to save all water that has been used for household purposes. This is excellent for the garden, and even where water is abundant it should be preserved. The loss annually from the waste in an ordinary household is surprising when its value as manure is considered. This is one of those little matters that deserves thought, but which is only too often overlooked. In the rainy, moist parts of the Colony the difficulty of preventing the growth of weeds is considerable, and sometimes almost impossible. One of the worst of the weeds is the common summer grass, *Panicum sanguinale*, which grows with wonderful rapidity, and soon overtops all vegetables if not prevented. The hoes must be kept exceedingly sharp, but great care must be taken with their use, as a mere touch may destroy a vegetable.

As seeds of many different kinds of vegetables should be sown this month, in order to raise plants for transplanting later on, a good deal of trouble should be taken to make suitable seed-beds or to prepare boxes or pots in which to raise them. As pointed out some months ago, a small portion of the garden should be set apart for raising seeds. This could be made a most useful, interesting, and instructive place, where various little experiments could be carried out, where cuttings could be struck, seedling fruits raised, and so on. The time necessary to spend here need not be great, but it would serve to break the dull monotony of the usual farm life, and improve the mind by providing food for thought.

French Beans.—These may be sown during the month as largely as may be considered necessary. The reader's attention is directed to an article in this *Gazette* by Mr. Valder, showing the results of some careful experiments made

with beans. It will be seen that the variety named Canadian Wonder is the most profitable one to grow. It can be highly recommended. A variety named Sutton's Selected Canadian Wonder, raised in England, is said to be an improvement on the Canadian Wonder. "The pods are of immense length, very handsome, and are fit for use several days earlier than that good old variety, although sown at the same time." It is not known whether this variety has yet been tested in the Colony.

Beet, Red.—Sow a little seed in rows. Probably one row will be sufficient at a time. Select rich ground, such as had been heavily manured for some previous crop. Before sowing the seed make a shallow drill—say about an inch or so deep. If the soil has been made quite fine a drill can be made with the forefinger. Drop the seed in the bottom of the drill, and if the soil is dry, water well before covering up, so as to give the seed a thorough soaking, and then cover over with fine soil, and press it down with the back of the spade. Always use a line to mark out the rows. A thick piece of string will serve the purpose well, and will last for a long time if taken care of. Plants that are growing should be thinned to about 9 inches or even to 12 inches apart in the rows. If the young beets that are thinned out are lifted with a little care they may be planted out if required.

Beet, Silver or Spinach, is an excellent vegetable to grow. Sow a little seed in rows, and afterwards thin out the seedlings when they have attained a height of about 2 or 3 inches. It may, perhaps, be more convenient to sow in a seed-bed and afterwards transplant in much the same manner as is adopted for cabbages, &c. The soil for this plant should be heavily manured with well-rotted, rich manure, for the leaves, and not the root, is the part used as a vegetable. The rows in the permanent bed should be about 2 feet apart, and the plants should stand about 2 feet, or so, distant from one another.

Borecole or Kale is best suited for the cool parts of the Colony. It belongs to the Brassica or cabbage family. The seed should be sown in seed beds or boxes, and the seedlings afterwards transplanted. The soil should be made rich with well-rotted stable manure. Plant in rows 2 feet apart each way.

Broccoli resembles the cauliflower, and might easily be mistaken for it; in point of fact, it is a variety which takes longer to arrive at maturity, and there are other differences which are very apparent to one used to growing vegetables. Seed to a small extent may be sown in a box or seed-bed.

Brussels Sprouts.—This is another and excellent variety of the cabbage, but differs in a most marked degree from that vegetable. The stem grows to a considerable height, and bears numbers of miniature cabbages. It is very suitable for cool districts, and should be grown wherever it will thrive, for it is one of the best of vegetables, and can be grown as easily as an ordinary cabbage. Seed should be sown in a box or seed bed, and every care should be taken in watering and shading sufficiently. When the plants are large enough they should be moved to well dug up but not too heavily manured ground that has been prepared for them. The growth should not be too rank, and the plants must not be forced or else the young sprouts will not form well. If the ground is naturally rich it may, perhaps, be as well not to apply manure. However, if they do not thrive, manure can easily be applied in a liquid form. Plant in rows about 2 feet 6 inches apart. The plants to stand about 2 feet from each other in the rows.

Cabbage.—Sow seed in as great a quantity as may be needed, in a seed-bed. Sow thinly in little rows, about 2 inches apart. A few plants may be set out in well manured ground, from time to time, in order to keep up a succession.

Carrot.—Prepare some ground by digging deep and fine, and by well draining, but avoid applying manure unless absolutely necessary, and then take care that it is old and thoroughly rotten. The best way to manage is to use a bed, or part of a bed, which had been heavily manured for some other vegetable. If fresh manure is used the roots will, in all probability, become forked, and of bad shape. Sow the seed in drills, which should be made not deeper than half an inch. Cover over with fine soil, and firm down with the back of a spade. The seed is covered with little hooks, and care should be taken that it be well separated before sowing. The drills should be from 1 foot to 18 inches apart. The seed will take a good while to come up, and as the plants are exceedingly small at first the weeds should be looked to as often as possible.

Cauliflower.—Seed of this favourite vegetable may be sown largely during the month in a seed-bed, box, or pot, in the same way that cabbage and all others of the same family are sown. The seedlings, when large enough to move, will be improved by being planted out or "pricked out," in a small bed, about 4 inches apart, where they can develop into good, strong, young plants for transplanting. The distance apart the plants should stand will depend on the richness of the soil. The better the soil the wider apart the cauliflowers should be planted. The distance may vary from about 2 feet or 2 feet 6 inches to 3 feet. At the same time it should be kept in mind that although the soil may be poor, and but little manure has been dug into it, the plants can be fed by liquid manure, and made to grow to a very large size. In a few words, the distance at which plants should stand from one another will depend, in a great measure, on the quantity and quality of plant-food available.

Celery.—Sow a pinch of seed in a box or pot. When the plants come up, and are large enough to shift, prick them out in a small bed, where they can grow strong and hardy.

Endive is a good substitute for lettuce. A little seed may be sown during the month.

Turnip, White.—Seed may be sown in drills, in well-manured ground. When the plants come up, thin out well.

Turnip, Swede.—Sow as largely as necessary, as above.

Potato.—An effort should be made to raise a good supply of this useful vegetable. The soil should be well drained, well worked, and heavily manured with the droppings of farm animals. For seed, medium-sized whole potatoes are to be preferred to large ones cut into sets. The rows had better be wide apart, say 3 feet, and the sets put in about 1 foot apart in the rows. Plant about 5 or 6 inches deep. If it is necessary to use cut sets take care that the cut sides are dry before planting.

Peas.—If the weather is moist a few rows may be sown in the cool districts. The dwarf varieties are to be preferred for this season of the year.

Radish.—Sow a few rows occasionally during the month. Use well-rotted manure, and water occasionally if the weather is very dry.

Orchard Notes for February.

All over the Colony February is a fairly busy month for the fruit-grower, for, though a large portion of the peaches, plums, and pears, early apples, and all the cherries and apricots have been disposed of, there is still a large amount of fruit to market, so that the principal work during the month, as during January, will be the gathering and disposing of the fruit. The remarks that have previously appeared in these notes about the care to be taken in the grading, packing, and handling of the fruit should be borne in mind. It is impossible to impress upon the fruit-grower too often or too strongly the necessity for carefully attending to this most important matter. It is an undoubted fact that the better the appearance of the fruit when placed on the market, the better it will sell.

The cultivation of the orchard should be carefully attended to during the month, as if neglected the late fruits are likely to suffer. This is especially the case in the drier districts of the Colony where, as has been previously stated, the secret of success in fruit-growing is keeping the ground in a thorough state of cultivation. During the month the banding of the trees for codlin moth should be carefully attended to, and the bandages should be removed, and the worms destroyed every ten days, or at the outside every two weeks. If grasshoppers or crickets are destructive, they must be fought by poisoning the food on which they are feeding. The best remedy to use in this case is Paris green, 1 lb. to from 160 to 200 gallons of water, according to the nature of the plant to which it is to be applied. The softer and more easily injured the plant the weaker the mixture.

Drying should be continued during the month, either by the use of an evaporator, or by means of the sun in the drier districts, but even in the latter, it will be necessary to provide arrangements for covering the fruit in case of rain, so that an evaporator is usually preferable. By means of drying or evaporating, much fruit that is at present wasted might be utilised and converted into a marketable commodity. The requirements in fruit for drying are a firm solid flesh, and a juice rich in sugar, to produce the best results.

Budding over unsuitable varieties of fruit may be continued during the earlier part of the month, especially in the later districts, and the buds that were put in during January should be attended to, and the ties cut where necessary. It is not a good plan to start the buds the same season that the trees are budded, and for that reason it is not advisable to bud too early. The requirements necessary for successful budding are, first, that the stock is in good working order—that is to say, the sap must be running, and the bark lift easily; secondly, that the buds are strong, plump, and well developed, and are taken from none but healthy vigorous trees. In tying the bud always take care to tie very tightly up to the shoulder of the bud, as that is where the union must take place. Nursery work will consist in keeping the rows clean and well worked, and in attending to the budding, removing the ties, &c.

General Notes.

The Export of Wines.

The difficulties connected with the placing and disposal of pure and sound Australian wine on the London market bid fair to be finally and satisfactorily overcome. A letter has been received by the Department of Agriculture from Mr. C. A. W. Lett, Curator of the New South Wales section of the Imperial Institute, in which that gentleman points out that at present, owing to the unsatisfactory manner in which the Australian wine trade has been manipulated, English consumers have become prejudiced. The chief cause of this is the difficulty of obtaining regular supplies of wines of even quality—the many cheap concoctions of Italian and Spanish wines that are sold under the denomination of Australian wine have also seriously affected their reputation.

It appears that constant inquiries are being made at the Institute as to where really good light Australian wine can be procured, and as a first step towards meeting the evidently growing demand, Mr. Lett offers to make arrangements to have any sample shipments forwarded to him sold in the dining-rooms and bars of that Institution and other places of popular resort. For this purpose he suggests that the most suitable wines to send are those of fair age and maturity, which could be retailed at about 25s. per dozen for family use. He will also be willing to arrange to dispose of bulk wine of similar quality, in octaves and quarters, samples of which could be sold at the Institute and other places of public resort at 4d. per large glass. Mr. Lett mentions that at the present time there is not a single place in England where Australian wine of a reliable quality can be obtained by the glass, and that such an innovation will be very popular and do much to increase the demand for our wines, and to break down the prejudices which at present exist against it; for it is only by, in the first instance, having them sold in this manner that they can be really popularised, and the public taste gauged. There is also a demand for the more expensive wines, the disposal of which Mr. Lett will also be glad to supervise, which would compete with Beaune and Burgundy sold ordinarily at 36s. to 50s. per dozen, and it is not considered that the sale in the manner proposed of the cheaper wines would adversely affect this class of trade.

Fully recognising the absolute necessity of exercising a wise discretion in regard to the wines to be shipped, the Department has been successful in obtaining the consent of Mr. P. F. Adams and Dr. Fiaschi to form, in conjunction with Mr. J. A. Despeissis, Consulting Viticulturist to the Department, a committee to test any wines that may be submitted before such wines are shipped to London, the Department taking no responsibility beyond the testing and ascertaining that the wine sent in bulk for shipment corresponds to the sample, and is of the required quality.

These gentlemen have already held a preliminiary meeting, at which a scheme was drawn up which it is hoped will be practical and effective, and the Department hopes to be in a position to announce shortly to wine-growers what steps it will be necessary for them to take in order to be benefited by the services of this committee. In spite of any energy which may be displayed it will of course be seen that complete arrangements, including the dealing with shipments in London, will necessarily occupy considerable time, but by means of this early intimation it is thought that intending shippers may be able to consider the matter, and make necessary preparations for taking advantage of so promising an opportunity of extending their business.

So soon as the brands and types of wines best suited for export become well established, Government advice will be suspended, and the trade left to progress on its own merits. Full particulars as to the cost of freight, &c., may be obtained from the Department of Agriculture.

Planter's Friend.

The following notes as to the production and composition of the variety of sorghum known as Planter's Friend may be of interest to sorghum growers:—

Mr. W. Graham, of Minnamurra Farm, Jamberoo, communicates the following results of his sowing:—

The seed was sown late in December, 1892, at the rate of a little over 16 lb. per acre. The crop cut from 6¾ acres during the months of May and June of this year, amounted to 247 tons 14 cwt. of fodder, being an average of 36 tons 14 cwt. per acre.

Cost of Production.

	£	s.	d.
Ploughing, harrowing, sowing, and seed, at £3 per acre	20	5	0
Rent	5	0	0
	£25	5	0

Average cost of production 2s. per ton.

The paddock where this crop was grown is situated on the northern side of the Minnamurra River, having a south-westerly aspect. The soil is fairly rich, being of volcanic origin. It has been grazed for years without manure, and it is stated that it has been cropped with wheat upwards of forty years ago. The fodder has the following composition as determined by the chemist:—

Water	73·32	per cent.
Ash	·95	„
Albuminoids	2·28	„
Ether extract	·55	„
Crude fibre	6·06	„
Carbo-hydrates (nitrogen free extract)	16·84	„
	100·00	„
It contains sugar	5·76	„
Nutritive value	20½	„
Nutritive ratio	1–8	„

It will be seen from this that the feeding value is fairly high, and the proportion of albuminoids especially high.

It would be of interest to determine its value in the production of milk. It will probably be found most valuable as a mixed food with bran.

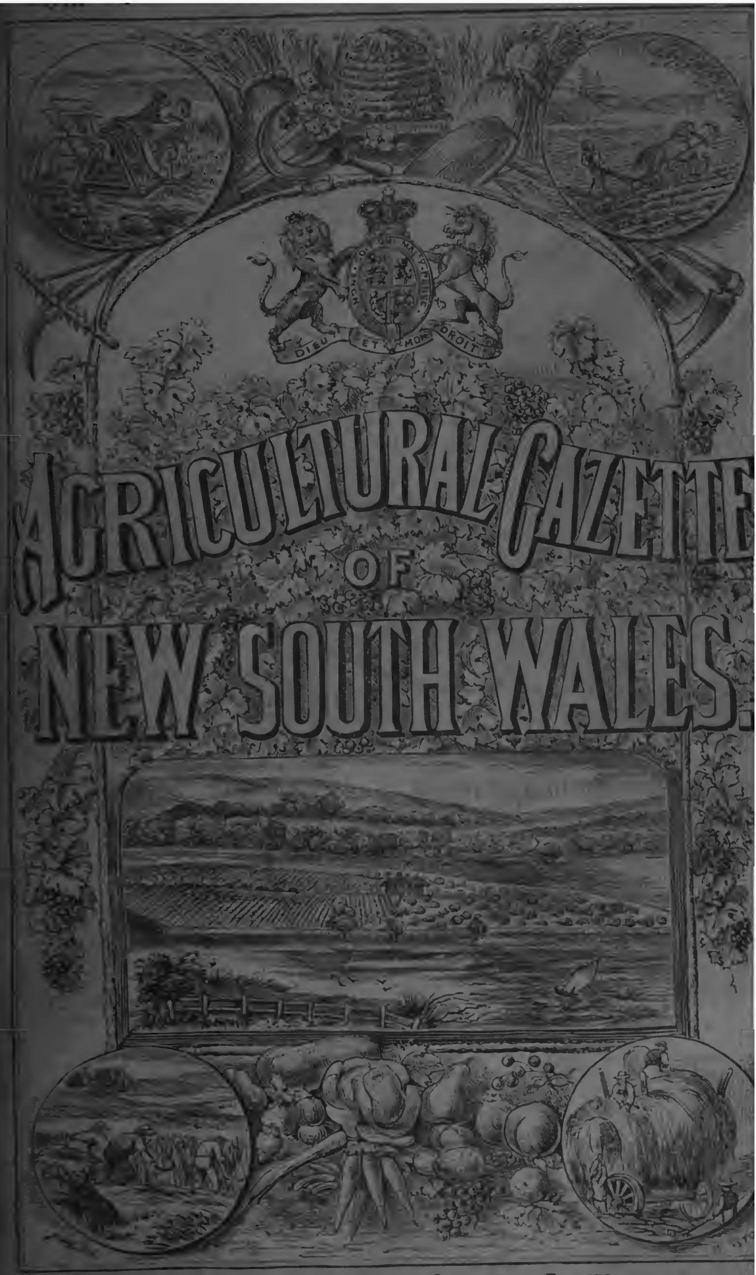
Rust-resisting Wheats.

In the July issue of last year we published a list of wheats which had been distributed to farmers, with a view to testing their rust-resisting qualities in different parts of the Colony. It was known at the time that under certain conditions some of those wheats were liable to rust, but owing to their possessing such good qualities as earliness in maturing and prolificacy, it was decided to include them in the distribution. The results of still further experiments which are being carried out by Mr. Wm. Farrer at Lambrigg, Queanbeyan, enable us to somewhat qualify the former list, and the following may be taken as varieties which are now known to possess rust-resisting qualities, at any rate so far as that district is concerned:—

Amethyst,	Niagara,
Algerian,	Pringle's Defiance,
Bega,	Saxon Fife,
Belatourka,	Smith's Nonpareil,
Blount's Lambrigg,	Square-headed Sicilian,
Blount's Fife,	Summer Club,
Egyptian Mummy,	? Talavera,
Fluor-spar,	Thomas' R. R.,
Fultz,	Tourmaline,
Hornblende,	? Victorian Defiance,
Improved Fife,	Ward's Prolific and Ward's White,
Manitoba,	White Fife,
Medeah,	58 A (Jock).

A New Calf-feeder.

According to the *Melbourne Leader*, the firm of Messrs. Clarke & Co., of Elsternwick, Victoria, have succeeded in devising a very useful and, at the same time, inexpensive calf-feeder. The feeder consists of a tube about 15 inches long, at one end of which is fixed a strainer, while to the other end, which is bent, is attached an indiarubber teat. In using the feeder it is only necessary to place the bucket of milk on one side of a fence, and drop the strainer-fitted end into the milk, while the teat end is passed through a hole in a fence, and given to the calf, which may then be left to suck away at pleasure. There is a shield fixed to prevent the calf pulling the tube through a fence, and of course there is no possibility of the bucket being upset. Under this arrangement the calf feeds in a natural manner, inasmuch as the use of the teat excites salivation, whereas in drinking from a bucket, in the usual way, the calf gulps down a quantity of milk which it cannot readily digest. It is reported that several well known farmers have adopted the feeder after satisfying themselves of its utility.



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Eucalyptus rostrata, Schlecht.

"Murray Red Gum."

Useful Australian Plants.

By J. H. MAIDEN,
Consulting Botanist.

No. 6.—The Murray Red Gum (*Eucalyptus rostrata*, Schlecht).

Other Vernacular Names.—The "Flooded Gum" of the interior of Western and South Australia. In western New South Wales it is called "Creek Gum," as it is always found near watercourses. There are several trees which grow under the name of "Red Gum" in these colonies. One of them is the smooth-barked Apple (*Angophora lanceola*), which in New South Wales is often called red gum, but most of the trees known by that name are Eucalypts. The red gum of Western Australia is *Eucalyptus calophylla*, while in the neighbourhood of St. Vincent's Gulf, South Australia, *Eucalyptus odorata* goes by that name. In our own colony two other valuable timbers also go under the name of red gum, viz., *Eucalyptus tereticornis*, a tree bearing close affinity to *rostrata*, but it is essentially a *forest* timber, in contradistinction to *rostrata*, which is a *river* timber. Then the leather-jacket or grey gum (*E. punctata*), is also known as red gum occasionally; but *the* red gum *par excellence* of these colonies is *Eucalyptus rostrata*, and by way of distinction I have denoted it, on account of its most celebrated locality—Murray Red Gum. It is the tree which produces directly to the Colony by far the most revenue of all our trees, and it is so important and so interesting to us in various ways that I propose to deal with it in detail.

Aboriginal Names.—By the aboriginals of the Lower Murrumbidgee it used to go by the name of "Biall," while to those of the western interior it was known as "Yarrah," a name which it shared with some other trees.

Botanical Name.—*Eucalyptus*, from two Greek words, eu-kalyptos, signifying "well-covered," and alluding to the little cap (usually more or less conical or dome-shaped) called the operculum, which covers up the unexpanded flower, and which is thrown off as the flower opens. *Rostrata* is a Latin word, signifying beaked or snouted, and this specific name was given to the red gum, because of the beaked appearance of the flower-bud.

Flowers.—This is a good honey-yielding tree. Mr. E. A. Coleman, a bee-keeper, of South Australia, pronounced it, when speaking of the trees of that colony, to be "about the best."

Leaves.—The leaves of the red gum emit a pleasant odour when crushed in the hand, but the eucalyptus oil they contain is not a regular article of commerce, as it is not yielded in payable quantity. Mr. Bosisto thus reports on it in the *Trans. Roy. Soc. of Victoria*, vol. vi, 1861-4:—"Plants grown on high ground give an oil of a dark-amber colour, possessing an

agreeable aromatic flavour, and having the odour of caraways. The yield from 100 lb. of the fresh-gathered leaves was 1 oz. 6 dr. The plants grown on low marshy soil yielded an oil of a pale-yellow colour, in appearance and smell similar to that yielded by *E. odorata*, the quantity being $9\frac{1}{3}$ dr. to 100 lb." Last year, M. Mellon, of the Dunolly Scent Farm, Victoria, obtained no less than 7 oz. of oil per 100 lb. of leaves.

In Mueller's edition of Wittstein's work we find the following:—"The essential oil is pale-yellow to reddish amber in colour; it smells and tastes like that of *E. odorata*. Its specific gravity is 0·918, and it boils at 137° to 181° F."

The celebrated essential oil firm of Schimmel & Co., of Leipzig, Germany, have also examined this oil (*vide* their *Bericht* for October, 1891). Their oil was prepared by M. E. Mojon, of Algiers, from trees grown in that country. They determined the specific gravity of their sample to be 0·924 at 15° C., and the optical activity + 12° 58′ in a 100 mm. tube. The oil has a powerful odour of valerianic aldehyde, and is rich in lineol. *E. rostrata* and *E. globulus* appear to be the only two eucalyptus oils known to contain valerianic aldehyde up to the present.

Quite recently, Mr. W. Percy Wilkinson, of Melbourne, has made a valuable preliminary investigation of the eucalyptus oils of Victoria (*Proc. Roy. Soc., Victoria*, 1893, p. 195). Amongst others, he has examined three specimens of red-gum oil, and following are his results:—

Sample.	Specific gravity.	Specific rotation.	Refractive index.	Specific refractive energy.
1	·9120	+ 8·7°	1·4604	·5072
2	·9216	+ 2·2°	1·4600	·5014
3	·9222	+ 0·5°	1·4607	·5018

None of them gave the Phellandrene reaction.

Exudation.—The kino of the red gum is perhaps the best known of all eucalyptus kinos, chiefly through the enterprise of Mr. Joseph Bosisto, of Melbourne. In the Deniliquin district at least, fishermen and others chop a few chips in the bark of the red gum and extract the liquid kino from the trees. This kino is sent to Melbourne in jars, and it yields about 8d. per lb. in the Melbourne market. As this substance is a Colonial vegetable product in regular demand, it will be useful to some people to have the following notes of it which were published by me in the *Proceedings of the Linnean Society of New South Wales* for September, 1891:—

It is a useful astringent, and it seems to be increasing in favour with medical men in England, America, and Australia.

The official kino (*Pterocarpus*) contains, I believe, no substance which is not contained in this and some allied kinos, for which they appear to be a perfect substitute. See *Pharm. Journ.* [3] xx, 221, 321.

The kino of *E. rostrata* will be found mentioned in all modern works on Materia Medica. In Martindale and Westcott's *Extra Pharmacopœia*, for instance, we have the following:—

"*E. rostrata* and *E. corymbosa*, and probably other species imported from Australia. It is semi-translucent and garnet-coloured, not so dark as but resembling kino in appearance, soluble in water, tough, difficult to powder [not correct as applied to these two kinos.—J. H. M.], it adheres to the teeth when chewed, is intensely astringent to the mucous membrane, useful in diarrhœa, relaxed throats, and given with success to check the purging of mercurial pills."

But the following statements pertaining to the percentage of tannic acid and the solubility are somewhat misleading, since I have shown the enormous variation in the properties of kinos caused by age :—

"Of 100 parts, 90 are dissolved in cold water, the solution being clear; 27 parts of isinglass precipitate all the astringent matter.—Squire's *Companion to the B. P.*

Dr. Wiesner says of a sample :—

"Easily soluble in water and alcohol; solution neutral, free from gum-resin. Broken masses of zircon-red, sometimes light brown, mixed with bits of bark."

Following are experiments on "Red Gum" kino purchased in Sydney, 22nd November, 1888, of Victorian origin :—In lumps up to the size of peas, though angular. Prevailing colour, purplish-brown; is readily powdered between the fingers, forming an ochrey-brown powder. The mass of kino has not the brilliant appearance of the kinos of the ruby group, owing to this friability.

In cold water it dissolves fairly readily, and almost entirely to a reddish-brown liquid.

Its composition (determined November, 1888) is :—

Catechin and tannic acid	84·3
Ligneous matter, &c.	·3
Moisture	15·2
Ash	·2
	100·00

Tannic acid determination (Löwenthal), 46·22 per cent.

A specimen of kino from the "Creek Gum," Tarella, Wilcannia, 23rd August, 1887 (diameter, 1–2 feet; height, 30–40 feet), gave the following results :—It is only obtainable in rather small quantities, and in rather small pieces; pale, as kinos go, very bright-looking, and of a ruby colour; powders fairly readily, forming a powder of a light-brown tint. It dissolves almost immediately to a pale brownish or almost orange solution, leaving a sediment of a whitish-salmon colour with a few dark-coloured particles, like those of *E. goniocalyx*, only cleaner-looking.

Its composition, determined October, 1888, is :—

Catechin and tannic acid	82·7
Ligneous matter, &c.	·6
Moisture	15·8
Ash	·9
	100·00

Tannic acid determination (Löwenthal), 47·746 per cent.

Bark.—The bark of the red gum is white and smooth, with some of the outer bark falling off in thin patches. In the classification of eucalyptus trees according to their barks it falls under the head of "Leiophloiæ," or "smooth-barks."

Timber.—I do not suppose that there is a person resident in Victoria or South Australia for six months who does not well know what red gum is, but comparatively few people in New South Wales know the timber. The reasons for this appear to be two. The first is that our magnificent red-gum forests are practically at one extremity of our extensive colony, whereas in the other colonies red gum is extensively (though sparsely) distributed; and secondly, comparatively little red-gum timber is used in New South Wales for public works. The reason is, that we have had ironbark and other valuable timbers more readily available; but as ironbark becomes scarce I see in red gum a substitute efficient in various ways.

It is of a rich red colour, darkening much with age, close-grained and durable, almost as hard as iron when thoroughly dry, of inlocked fibre, difficult to split, but when sawn will rend and twist if exposed to great summer heat. Its hardness limits its use for furniture, though it is often used for that purpose in the southern colony. On account of its durability it is largely used for house-blocks, and also for paving-blocks, street-kerbing, slabs, posts, and piles in damp ground; hence it enters largely into the construction of wharves, bridges, &c. It is largely resistant to the

attacks of marine borers and white ants. It is not a good timber for decking and flooring, owing to its liability to shell off.

In giving evidence before the Victorian Vegetable Products Commission, Mr. Richard Speight, then Chairman of the Railway Commissioners, stated that this timber and that of *E. hemiphloia* and *E. leucoxylon* were found best for railway sleepers, and of equal value. It is used for wheelwright's work, especially felloes, and also engine-buffers, &c.; in fact, it would be difficult to enumerate the multifarious uses to which this valuable timber is put, particularly in the colony of Victoria. According to Brough Smyth (*Aboriginals of Victoria*, i, 299), this is one of the woods used by the aborigines for making their clubs or waddies (Kud-jer-oongs or Gudgerons)

In the extreme western portion of New South Wales the variety known as "Creek Gum" is found, whose average height is 30 to 40 feet, and diameter 1 to 2 feet. Locally it is not considered of much use, except for firewood. But the limbs and branches make excellent charcoal; a charcoal-burner prefers it to any other wood for the purpose, and a local blacksmith pronounces the product excellent. It is the opinion of a good many people that red gum yields the best charcoal in Victoria for blacksmith's purposes.

Tests.—Some Victorian specimens of red gum were examined for tensile strength by Mr. F. A. Campbell (*Proc. Roy. Soc. Victoria*, 1879). His results are 14,000 to 21,500, 16,200, and 15,700 lb. per square inch. The last specimen was at a disadvantage, not being perfectly straight. They all broke with a long fracture. For particulars as to the conditions under which the experiments were conducted, Mr. Campbell's paper must be referred to.

In the Annual Report of the Secretary for Mines, Victoria, 1892, are some results of tests by E. R. Meekison. The pieces tested had been seasoned for nine months, and were all planed to 1 inch square. All the tests were made with the weight in the centres, and the ends free; the distances given were those between the supports.

From the tests, the following co-efficients of rupture were obtained:—Ironbark, 19; blue gum, 18; stringybark, 17; red gum, 7·5.

Following are the figures obtained with red gum:—

Tests 2 feet between the supports:—

60 lb. deflection $1\frac{7}{16}$"
120 lb. ,, $1\frac{7}{8}$"
140 lb. breaking weight.

Tests 4 feet between the supports:—

20 lb. deflection $1\frac{7}{16}$"
40 lb. ,, $2\frac{1}{16}$"
60 lb. ,, 3"
80 lb. breaking weight.

Tests 6 feet between the supports:—

20 lb. deflection $2\frac{1}{4}$"
40 lb. ,, $3\frac{3}{5}$"
60 lb. ,, 5"
80 lb. ,, $7\frac{1}{16}$"
85 lb. breaking weight.

A number of experiments on the tensile strength of dark red gum and pale red gum (both *E. rostrata*), by Baron von Mueller and J. G. Luehmann, will be found in the Baron's "Eucalyptographia." Decade 6 (under *E. globulus*). These are reprinted in a *Catalogue of Timbers of Victoria in the Technological Museum of Melbourne*, by Baron von Mueller (1885), and the reader is referred to either of these works.

A series of tests on the elasticity and strength of red-gum timber, by Mr. J. Lunt, Engineer for Existing Lines, Victoria, will be found recorded in the 4th Progress Report of the Victorian Royal Commission on Vegetable Products, page 490. They are far too long to quote here, but will be found to be valuable to engineers and others interested in this excellent timber.

And last, but certainly not least, are the results of tests of red gum from New South Wales, Victoria, and South Australia, carried out by Professor Warren, and epitomised in his valuable record of tests entitled "Australian Timbers." The results are too technical for reproduction here, but the engineer needs only to be reminded as to where they are to be found.

The Murray Forests.—Following are extracts from an interesting report made by Mr. Inspecting Forester Manton on the Murray Red-gum Reserves. The report was made as far back as 1889, but Mr. Manton does not wish to add to it:—

The largest, best, and most heavily-timbered of the reserves are on the Murray River, extending from the junction of the Ovens River to Campbell's Island. These areas contain red gum, pine, box, and occasionally a few myall and other trees may be met with, but not in sufficiently large numbers to be of any commercial value.

The chief and characteristic timber of the Murray Forest Reserves is the red gum, which is far in excess of any other description, and comprises fully two-thirds of the total area reserved for timber purposes. The pine forests are sparsely scattered through the reserves, and in most instances the matured timber has been removed some years back, pine being principally used by the Murray settlers for building and fencing purposes, and some considerable quantity has been exported by river to the Darling and Murrumbidgee. Many thousands of these valuable trees have been cut down for the construction of chock and log fences. This class of timber would be in great demand, were it procurable in sufficiently large quantities, as it is the best timber we have to resist the attacks of the white ant.

The remainder of the forest reserves are clothed with box and a few other trees, at present of little or no commercial value. On some of the reserves are small open plains of small area, but very few of the areas are fit for agricultural purposes, as they are subject to annual inundation.

Box intersects the various red-gum forests in belts of various extent, and, as has already been stated, comprises, with the exception of a few trees of other varieties, and small plains, about one-third of the whole of the Murray Forest Reserves. This timber is at present of little or no commercial value, except for firewood . . . but eventually an increasing revenue may be looked for from this timber.

Taking two-thirds of the Murray Forest Reserves, I estimate that there are at present two matured red gum trees to the acre fit for sawmill purposes on them; many fully-matured trees are valueless to the sawmiller, owing to their being pipy, spongy, or of crooked growth; this class of timber may be computed at about eight to the acre. Young, vigorous, healthy trees, varying in diameter from 16 to 20 inches, may be reckoned at from 6 to 8; there are a great number of trees of a lesser growth—in fact, it would be impossible to give anything like an approximate estimate of their number; in parts they are growing so thickly together, that it is questionable whether they will arrive at maturity unless some system of thinning be resorted to.

I may state that the principal demand for red-gum timber is chiefly by Victorian saw-mill owners on the Murray, who cut fully nine-tenths of our timber, which is used in that colony in connection with public works, such as railways, bridges, harbour works, and all constructions requiring strength and durability. The rest is used locally, or sent to the Darling and Murrumbidgee districts. Echuca is the main depôt and centre of the Murray timber trade. The principal means of transit for nearly the whole of the timber on the Murray forests is by river; the logs are hauled to the river bank in jinkers, thence floated down with the stream from the reserves above Moama in barges constructed for the purpose to long transverse outriggers, to which the logs are suspended, half in and half out of the water. The barges when drifting down the stream are kept in the middle of the river by means of a long chain dragging along the bottom of the river, attached to the stern-post of the barge; this plan of keeping the barge in the centre of the river was only discovered accidentally a few years back. From below Moama, when the logs are not sawn in the immediate neighbourhood, they are loaded in barges and towed up stream by steamers to the different saw-mills of Echuca, and the sawn timber is sent by railway to Melbourne, with the exception of the small quantity that goes by river to the Darling and Murrumbidgee.

The demand for timber from our reserves by the Victorian saw-mill owners has been gradually increasing year by year proportionately as it becomes scarce on their side.

There are nine saw-mill plants on the Victorian bank of the Murray fronting our forest reserves. I estimate that these mills are capable of turning out 71,000 superficial feet of timber every day. On this side there are but three, two of which are on Gulpa Creek, capable of turning out 11,500 superficial feet per day, and one on the Murray frontage, on the Barham State forest, county of Wakool, with a capacity of 6,000 superficial feet per day; this mill is owned by a Victorian company, so that we really have but two mills on this side owned in this Colony.

In view of the large quantity of red gum that is being taken from our forest reserves, it may, perhaps, be advisable to entirely close some portions of these reserves against timber-cutting. I estimate that at present fully one half of our mature red-gum trees fit for saw-mill purposes have been removed; young trees, from 2 feet down to 1 in diameter are very numerous; but under the present demand for timber it is questionable whether they will arrive at a sufficient size to keep up the supply before those already matured are removed; but from my long experience in connection with red-gum forests in this district, I am perfectly certain that under a judicious system of ring-barking the old and useless trees, so that others may take their place, and thinning out the saplings when the growth is excessive, so as to allow a rapid and vigorous growth of the best young trees, these forests can be made capable of supplying not only our own requirements, but to sustain an extensive export demand for all time, and prove a valuable source of wealth to the State.

The process of spontaneous re-foresting is going on at such a rate that I believe that I am safe in stating that there are at present ten times the number of young trees that there were fourteen years ago.

Size.—Up to a height of 200 feet, and a diameter of 4 to 6 feet, and even more. Acquires a girth of 3 feet 6 inches to 4 feet in thirty years. (Mr. James Shackell, M.L.A., Victoria.)

Distribution.—The red gum prefers the banks of rivers, or river-flats subject to inundation, rejoicing in rich alluvial soil of a humid character. In New South Wales the red-gum grows on the Murray and Edwards Rivers to the greatest perfection. The red-gum flats are subject to inundation, rendering these forests unsuitable for agricultural purposes, and hence they will remain forests for an indefinite time. Beyond the Dividing Range the red gum has a very wide range, being found on the banks of the Cudgegong, Castlereagh, Darling, &c. It is usually found near rivers, and is also sparingly found in the coast country, except from the Victorian boundary to the Bega district. In Victoria it is found on river-flats and open valleys in most parts of the Colony, and in South Australia it is likewise very extensively distributed. It is also found in South-west Queensland.

The way in which the red gum (yarra) usually marks the course of water was early observed by Sir Thomas Mitchell:—"The yarra grew here (Lachlan), as on the Darling, to a gigantic size, the height sometimes exceeding 100 feet. The yarra is certainly a pleasing object in various respects; its shining bark and lofty height inform the traveller of a distant probability of water, or at least of the bed of a river or lake, and being visible over all other trees, it usually marks the course of the rivers so well that in travelling along the Darling and Lachlan I could with ease trace the general course of the river, without approaching its banks, until I wished to encamp." [*Three Expeditions*, ii, 54.]

This useful tree has been introduced into several countries (chiefly through the agency of Baron von Mueller), with varying success. For particulars of most of the results, see Mueller's "Select Extra Tropical Plants" (Victorian Edition). For results in Assam, see Kew Report for 1879, p. 16; and for results in India, see Kew Reports, 1876, p. 23; 1879, p. 16; 1881, p. 12. Vilmorin, of Paris, has distributed a good deal of red gum in Europe. Some years ago I received from a correspondent at Oporto, in Portugal,

flowers and fruits of trees raised from such seed, with the report that the species does well in that country. The red gum has been planted by a number of people in California, and is favourably reported upon by the local forest conservator.

The following statistics from the Forest Department are interesting:—

Red Gum.

Forest Reserves, Murray District.

County.	Number of Forest Reserves in each County.	Area, in acres.
Cadell	6	58,802
Denison	19	14,553
Hume	10	7,607
Townsend	8	71,980
Wakool	19	94,003

Red Gum.

Murray District.

Years.	Number of superficial feet.	Royalty on timber.	Area thinned.	Cost of thinning.	Remarks.
		£ s. d.			
1883...	4,322 821	4,322 7 1	......	....	Area of red gum on The Murray about 225,000 acres. About 50,000 acres of a dense growth of red gum saplings which require thinning.
1884...	9,166,403	4,674 7 1			
1885...	3,975,541	2,077 17 5			
1886...	6,305,716	3,623 10 4			
1887...	6,767,946	3,812 5 8			
1888...	16,119,490	9,692 14 7			
1889...	13,817,393	7,874 17 1			
1890...	8,649,993	5,777 5 5			
1891...	8,571,748	6,015 1 11	7,500 acres	£1,428 2 4	
1892...	8,059,578	5,151 18 0			

Propagation.—By seed, which is a regular article of commerce.

Reference to Plate.—A, Flower-buds, showing beaked operculum; B, fruits; C, part of leaf to show venation (magnified).

Botanical Notes.

BY J. H. MAIDEN,
Consulting Botanist.

FIBRE OF *Hibiscus heterophyllus.*

MR. HODGSON, of "Sherwood," Macleay River, has sent to the department a nicely prepared sample of the fibre of this plant. He states that the Macleay River blacks used to call it "wyrrung." The late Sir William Macarthur says the Brisbane Water blacks used to call it "dtharange-gange." We often call it "green kurrajong." It is a tall, lanky shrub, as a rule, though under favourable circumstances, or under cultivation, it grows to be a neat small tree. It has large white flowers, with crimson or purplish throat. The bark of this and of all species of *Hibiscus* contain more or less fibre. It is white, strong, of fine texture, and is prepared by maceration. This is one of the fibres of which the aborigines used commonly to make their dilly-bags, rope, fish-lines, twine for nets, and thread. Fibre of this species has often been sent to international exhibitions, and also of *Hibiscus splendens*, from the Richmond River, to a less extent. Mr. E. Palmer gives the native name of *Hibiscus panduriformis* on the Mitchell River as "Bee-allo," and states that the bark is peeled off, cleaned, and twisted into twine, and into bags for carrying roots, game, &c. But of all Australian species of *Hibiscus*, *H. tiliaceus* of the Richmond River, near the coast, and coastal Queensland, has received most attention as a fibre plant. It is found in most tropical countries. The fibre was used by the aborigines for nets and fishing-lines. Some fibre produced in this Colony was pronounced by the jurors of the London International Exhibition of 1862 to be only fit for paper-making. It must have been crudely prepared, as the tree produces a good fibre in many parts of the world. Three or four years ago the Department of Agriculture of Queensland sent to London some fibre from the Daintree River, for report. The fibre "was roughly prepared by boiling in soda-lye, and rubbing with an old sack." The report was, "Good colour, moderately soft, but of no great strength, and fit only for jute purposes. It would, however, probably sell in large quantities, and we estimate the value to-day at £12 to £14 per ton in London."

But I am afraid there is no possible future for Hibiscus fibre in the world's markets; the utmost we can expect is to satisfy a small local demand for some inferior fibre. India is the home of Hibiscus. The products of different species are not always kept separate for trade purposes, but the principal hemp-yielding hibiscuses are *H. cannabinus*, which yields Bombay hemp, Ambari hemp, and Deccani hemp, and *H. sabdariffa*, which yields the Roselle. There are other species occasionally used as fibre plants. I note certain figures in regard to Bombay hemp. From official records it is stated

that the area under cultivation in the Bombay Presidency was, in 1885-6, 53,488 acres, in 1886-7; 87,957 acres, and in 1887-8, 71,588 acres. This refers to one species, to one Presidency, and labour of the cheapest kind, well accustomed to this sort of work, is employed. Also, the plantations are in the tropics, where fibre plants grow like weeds. It is facts like these which cause one to regretfully hesitate in recommending the cultivation of many fibre plants in New South Wales, and to throw cold water on the extraction of the fibre contained in many indigenous ones.

The Wild Parsnip as a Poison Plant.

With reference to the note in the November *Gazette*, page 913, as there is now reason to believe that the death of at least some of the cattle was caused by disease, the department is investigating the alleged poisonous nature of this plant, which was recorded as indubitably poisonous by high authority a number of years since. Pending the result of this investigation a full report (and illustration) of this plant will not be published.

Coffee Leaves as a Beverage.

A decoction made from the leaves of the coffee shrub has long been used in the Eastern Archipelago, and has more recently been introduced to the coolies in Southern India. A few years since it attracted considerable notice, and was recommended as a new article of import, to become a cheap substitute for tea. There seems to be no doubt that coffee leaves contain caffeine in sufficient abundance to make a valuable beverage, but the presence of an unpleasant senna-like odour would militate greatly against its popularity. As regards price, it is said that coffee leaves could be prepared (like tea) and shipped at 2d. per lb. as against teas at 6d. to 10d. There exists, however, the difficulty that depriving the tree of its foliage damages the crop of berries and injures the tree itself. On berry-producing trees, therefore, only the leaves obtained in the ordinary pruning operations would be available, and these would seem to yield so small a supply as not to be worth the cost of collection. Growing the shrubs for leaf alone would be a very questionable undertaking, but there appears to be no valid reason why, in the event of the berry crop failing, a portion, at least, of the leaves might not be gathered and prepared, if any means can be found of removing the objectionable odour. It has been urged that the product would be chiefly used to adulterate tea, but even supposing that such an adulterant could escape ready detection, the charge is not a very serious one.

A suggested New Material for Filling Pillows.

Mr. Forester Kidston, of Condobolin, writes:—"I forward samples of a weed which grows in great abundance in the Myall Plain country, on the Lachlan and Bogan. It is useless for stock, but the mature flowers rub up so fine that it appears to me that it would make an admirable substitute for feathers or kapok for filling beds, pillows, or cushions. It can be got in large quantities, and I will be glad to hear if you consider it of any commercial value."

The plant sent is *Craspedia pleiocephala*, F.v.M., and it belongs to the compositæ or daisy family, being a rather ornamental plant, with yellow heads of flowers.

Mr. Kidston's idea is ingenious, but I am afraid the article has no commercial future before it. The fragments into which it rubs up are botanically the individual flowers, and these individual flowers break up more or less into fine dust as they get dry, which is a serious drawback in a stuffing. Because of the smallness and "mobility" of the fragments, the stuffing could only be used for such articles as hassocks and solid cushions, *i.e.*, such as are not shaken, as pillows are, as, if the covering were sufficiently loose for the stuffing to shake about, it would settle towards the lower end of the covering. As a stuffing, therefore, it would have to compete with articles of the texture of chaff and bran. Most vegetable fibres for stuffing are exceedingly low in price, and the labour involved in reaping flower-heads would be far too expensive. The only possible opening I can see for the flowers would be in the event of their having any soothing effect in assuaging pain or inducing sleep, when used in the form of a pad or pillow (like hops and chamomiles), but, of course, this can only be proved by experience. We require more observers like Mr. Kidston to suggest means for the utilisation of our indigenous vegetation. The uses of very many plants are only awaiting careful observation and inquiry.

A Snatch Collection of Plants from the Bourke-Barringun Road.

By W.S.C.

Discovery of an Acacia new for the Colony.

Some little time ago, while visiting the artesian bores along the Bourke-Barringun Road, I snatched a few plants as I rode post haste through the country. Under the circumstances, no attempt to systematically collect was possible, but the plants secured give some idea of the vegetation of that part of the country. The collection includes Dodonæas, Eremophilas, Acacias, salt-bushes, and grasses such as are always more or less found in the district. *Acacia murrayana*, *Eremophila bowmanni*, and *Grevillea juncifolia*, are amongst the rarer plants, but the chief find is *Acacia patens*, F. v. M., which, Mr. Maiden informs me, is an addition to the flora of the Colony. It has previously only been recorded from the northern territory of South Australia, and the discovery of a plant new for New South Wales under the conditions of my trip indicates how desirable it is for people travelling in distant parts of the Colony to collect specimens of the vegetation, for we have much to learn in regard to the geographical distribution of Australian plants.

Portulaceæ.

Calandrinia (*Claytonia*) *balonensis*, Lindl.
Calandrinia (*Claytonia*) *calyptrata*, Hook. f.

Rutaceæ.

Geijera parviflora, Lindl.; "Wilga."

Sapindaceæ.

Dodonæa viscosa, Linn.
Dodonæa viscosa, Linn.; var *angustifolia*.
Dodonæa attenuata, A Cunn.; var. *linearis*.
Dodonæa boroniæfolia, G. Don.

The *Dodonæas* are known as "Native hops."

Leguminosæ.

Swainsona phacoides, Benth.
Cassia phyllodinea, R. Br.
Cassia eremophila, A. Cunn.
Acacia patens, F. v. M. New for New South Wales. A plant closely allied to *A. siculiformis*, with which it has been carefully compared.

Acacia sentis, F. v. M.; "Prickly Wattle."
Acacia murrayana, F. v. M.
Acacia salicina, Lindl.; "Kooba," or "Native willow."
Acacia ? Oswaldi, F. v. M.; pods only, no seeds; "Umbrella bush."
Acacia pendula, A. Cunn.; "Myall."

MYRTACEÆ.

Calythrix tetragona, Labill.; "Fringed myrtle."
Eucalyptus largiflorens, F. v. M.; "Swamp box."
Eucalyptus terminalis, F. v. M.; "Bloodwood" of the interior.

COMPOSITÆ.

Olearia pimelioides, Benth; syn. *Aster pimelioides*, A Cunn.
Angianthus pusillus, Benth.
Helipterum moschatum, Benth.

SOLANEÆ.

Nicotiana suaveolens, Lehm.; "Native tobacco."

MYOPORINEÆ.

Myoporum acuminatum, R. Br.; var. *parviflorum*.
Eremophila bowmanni, F. v. M.
Eremophila sturtii, R. Br.; a "Bastard sandalwood."
Eremophila longifolia, F. v. M.; an "Emu bush," or "Berrigan."
Eremophila maculata, F. v. M.; an "Emu bush," or "Native fuchsia."

VERBENACEÆ.

Verbena officinalis, Linn.

CHENOPODIACEÆ (Salt bushes).

**Chenopodium murale*, Linn.
Atriplex spongiosum, F. v. M.
Atriplex halimoides, Lindl.
Kochia triptera, Benth.
Bassia paradoxa, F. v. M.

PROTEACEÆ.

Grevillea juncifolia, Hook. f.
Hakea pampliniana, Kipp.

GRAMINEÆ (Grasses).

Panicum prolutum, F. v. M.
Andropogon sericeus, R. Br.; "Blue grass."
Poa cæspitosa, Forst; var. "Tussock grass."
Glyceria ramigera, F. v. M.; "Cane grass."
Bromus arenarius, Labill.; a "Barley grass."
**Hordeum murinum*, Linn.; a "Barley grass."

Those marked with an * are not natives of Australia.

Experiments with Pulses.

BY GEORGE VALDER,
Department of Agriculture.

LENTILS (*Ervum lens*, Linn.)

THREE very distinct varieties, viz., "Large Grey," "Egyptian," and "Spanish," were tried. They all came up well, and the former two grew very strongly, but the "Spanish" variety did not seem at home from the first, although it matured its seed, it had a very stunted and unhealthy appearance. Seven weeks after sowing all the varieties were in full bloom, and they were ready for harvesting about four to six weeks later. The following table will show the results obtained from each variety:—

No.	Name.	Seed obtained from—	Crop occupied the ground—No. of days.	Yield of dry pulse per acre. Bush. of 60 lb.
1	Spanish	Europe	91	9
2	Large Grey	"	78	41½
3	Egyptian	New South Wales ...	73	23

"*Large Grey.*"—This should prove by far the most valuable of the three varieties for cultivation in this Colony. On referring to the above table it will be seen that it gives a much larger yield than the other two varieties, and matures very quickly. The pulse also is much larger, being, when in the green state, fully as large as the finest garden peas. When dry the pulse is much flatter than a pea, but it is quite as big, whereas neither of the other varieties has seeds larger than a common vetch. I shelled out a dish of the lentils when they were quite green, and had them cooked and served up in the same way as green peas. They were very palatable, and should, I think, make a good substitute for green peas during the hot summer months. Dr. Marano, the Italian Consul, informs me that this lentil is largely used in Italy as a food. The dry pulse being either used in soups whole, or ground into pea-meal. Of late years the Italians resident in this Colony have been importing this pulse in fairly large quantities from Europe, there should therefore be a sale for it in Sydney. Being a very quick grower, requiring but little cultivation, and producing a large amount of foliage, it should prove a valuable plant for green manuring. The plot sown by me was ready for ploughing in six weeks from the time of sowing, and I roughly estimated the yield of green plant at that time at 6 tons per acre.

"*Egyptian.*"—A very hardy plant, but much smaller than the above, and foliage much thinner. When ready for harvesting the plants were covered very thickly with the small pods. Although it grows well here it is not nearly equal to the large grey variety in any way.

"*Spanish.*"—This sample was taken from a bushel of seed which the department imported from Messrs. Sutton and Sons, the well-known English seedsmen. Some 200 packets of the seed was sent to farmers in all parts of the Colony, and from what I can gather from reports received from them and my own observations, I consider that this is not a suitable variety for cultivation here.

Pigeon Pea (*Cajanus indicus*, Spreng.)

Two samples were tried—the red and the variegated varieties. The seed was sown in drills 4 feet apart, and the young plants were thinned out to 4 feet apart in the drill. At first they grew very slowly, but after a few weeks of hot weather they made rapid strides, and soon the plants in the two drills were touching. At this time they were fully 7 feet high, and were densely covered with foliage. They commenced to flower in February, and in about a fortnight later they made quite a pretty show, being thickly covered with bright yellow flowers. Towards the end of March I picked a quantity of green pods off them, and shelled out the peas and cooked them. They are of a very nice flavour, but are rather troublesome to shell out, both pods and peas being small. In April the plants were fairly well covered with pods, but they did not ripen well, the weather evidently being too cold. As a consequence, I could not get a fair estimate of the yield of dry pulse. The climate of Sydney is a little too cold for this plant, although I think that as it is a perennial it would ripen its seed earlier in the season the second year. On our northern rivers, and in several other of the warmer portions of the Colony, this plant should succeed very well. As a forage plant it should also prove of some value, especially in rotation with other fodder crops, such as maize, sorghum, &c. Six months after sowing the yield of green fodder was at the rate of nearly 12 tons per acre. I cut a quantity and gave it to horses and cattle, and found that they ate it with great relish.

Lima Bean (*Phaseolus lunatus*, Linn.)

I could only manage to obtain one variety of the Dwarf Lima bean, *i.e.*, that known as the Dwarf Bush Lima. This is a bean that is highly esteemed in the warmer portions of the United States of America, where they are grown in large quantities. With me the plants grew rather slowly until the weather became warm, when they grew quickly and soon began flowering. The pods grow in clusters of from four to ten on each stalk. The plants were not at any time more than from 10 to 12 inches high, and when in fruit they are almost borne to the ground by the weight of the large crop of pods. The pods should be picked as soon as they fill out, and beans then be shelled out and cooked and served up in the same manner as broad beans. I consider that for the warmer portions of the Colony this is one of the best summer vegetables grown. It simply revels in the hot dry weather. The yield of dry beans was very heavy, being at the rate of $37\frac{1}{2}$ bushels per acre.

WAGNER'S FLAT PEA (*Lathyrus sylvestris*, Linn.)

THIS sample was taken from a quantity which was imported by the department from England in August, 1890. The seed was distributed the following month to some 300 farmers in all parts of the Colony, and of these experimenters no less than 30 per cent. stated that the seed did not germinate. And yet a portion of the same seed which was sown by me with the other pulses two years later (8th October, 1892) came up very evenly, fully 60 per cent. of the seeds germinating. The plants, although looking perfectly healthy, grew very slowly, and at the end of nine months were not more than from 6 to 10 inches high. Of the fifty-four different pulses sown in these plots, this one was by far the slowest grower, and at the end of nine months only produced about half a ton of green plant per acre. Being a very deep-rooting plant, and a perennial, it was thought by some of the experimenters in this Colony that it might produce a large yield the second or third year, and that it would stand the dry weather well, but from reports received by the department it has certainly failed either in giving a good yield or withstanding the heat, and in many instances has died right out.

VILLOUS VETCH (*Vicia villosa, Linn.*)

THIS proved to be a dwarf-growing vetch with short runners. The plants grew very quickly, commenced flowering in from six to seven weeks after sowing, and ripened their seed in from twelve to fourteen weeks. As a forage plant it is not equal to the common vetch, the yield of green plant being 4½ tons per acre, and the yield of dry pulse 23 bushels per acre. It has often been recommended as a good food-plant for bees, and from what I could observe it certainly bears out its character in this respect, as the plants, which were in flower from six to seven weeks, were continuously visited by bees in large numbers. When in flower the plants are very beautiful, being profusely covered with long racemes of pretty pink and white or purple and white flowers. I should not advise its cultivation on a large scale, but think it is worthy of a trial in small patches by beekeepers as a bee and forage plant.

ALGERIAN VETCH (*Vicia calcarata*).

THIS vetch is one that will evidently stand great heat, but it does not yield well, and I cannot recommend it as a forage plant, there being so many species superior to it in every way.

LUPINS.

Two packets of lupins, which had been received by the department from Germany, were sown with the other pulses. These two varieties were said to be the best for green-manurings. One was a yellow-flowering variety and the other a blue. As a rule, I believe that the small-seeded varieties have been found the best. These were both rather large-seeded varieties, and as far as I could tell are not equal to the smaller-seeded ones which are obtainable here, the quantity of foliage produced being very small. I made a sowing in the spring in order that I might be able to more quickly increase

the quantity of seed by making two sowings in the year. This crop was harvested in about three months after sowing, the quantity of seed obtained being about 1¼ lb. of each variety. I thus had 2½ lb. seed ready for sowing in the autumn, which is by far the best season. This plot should produce about 100 lb. seed, which is sufficient to sow an acre. Complaints have been received by the department from farmers that it is very difficult to obtain sufficient lupin seed from the local seedsmen for sowing large areas. This experiment will serve to show how easy it is to obtain a large supply at a small cost and within a short period of time.

This completes the record of the fifty-four species and varieties of pulses sown in connection with this experiment. As will be seen, these seeds were obtained from all parts of the world, and they were in many cases three or four years old. Yet when sown with care not a single species or variety failed to germinate. Nearly all of them came to maturity and gave very fair results, thus proving how well the climate of this Colony is adapted for pulse-growing.

National Prize Competition, 1893.

F. B. KYNGDON, M.R.A.C

Champion Farms.

Owing to the floods which prevailed during 1892 over the north coastal district the competition for the champion prizes was deferred for a year. It was at first intended that Mr. J. L. Thompson, Principal of the Hawkesbury Agricultural College, should act as judge, but, owing to his duties rendering a prolonged absence impossible, the writer was invited by the Minister to undertake the responsible post. The first farm was visited on 10th October, and the last on 14th December, so that over two months were spent in continuous travelling, 2,800 miles being traversed, of which 1,000 miles were by coach. So very much of interest was observed in farms that may be regarded as typical of all that is good in the agriculture of New South Wales that a description has been prepared for publication, in the hope that a wide encouragement may be given to the pursuit of agriculture. Moreover, by the courtesy of the competitors sufficient data was afforded to enable a short outline sketch of their careers to be made, which may serve to show that by means of genuine hard work, and the taking advantage of local markets, fortunes have been, and still can be made by farming. In many cases there may be but little actual cash in the Bank, since the funds have been invested in the farm which yields, however, good interest for generous treatment, and affords many advantages that would have to be paid for handsomely by residents in a town. A champion prize of £50 was offered for the best mixed farm under 200 acres, and also one of £50 for the best mixed farm under 200 acres and up to 1,280 acres in the whole Colony, open to all winners of first prizes in 1890, 1891, and 1892. The entries for the smaller farms comprised five from the North Coast, extending from the Hawkesbury to the Tweed, four from the South Coast, extending from the Hawkesbury to Cape Howe, and one from the table-lands south of the Hunter River Valley. The tables attached to this article give full particulars as to the entries, area, and marks awarded.

The schedule of points furnished by the Department was as follows:—

System of underground drainage	*50
Conservation of water and its economic application	80
Character and condition of fences and gates	40
Plan, character, and condition of homestead and of farm buildings	40
Kinds of implements used, condition, &c.	60
System of cultivation, rotation, &c.	80
State of crops as to cleanness and cultivation	100
Productiveness of crops	50

* See tables, page 99.

System of manuring	*50
Conservation of manure made on the farm	50
Means used for conserving fodder	60
System of laying down grasses	20
Class and condition of live stock	50
Vegetable and fruit garden	25
Mode of book-keeping	20
Number and condition of subsidiary aids	80
Any new point of interest and commercial value, such as new crops, ensilage, &c.	20
General management with a view to profit	125
	1,000

In order to arrive at an acurate adjudication these heads were subdivided, as shown in the tables, p. 99–104, so as to give full value to each competitor. By their study it will be seen that the highest scorers made more points, because in their methods of farming they had so many more strings to their bow. The farming throughout was of a very high-class, reflecting great credit to the competitors. There can be no doubt but that these farms exercise an influence for good in their neighbourhoods, more especially since having entered for prizes offered by the Government they have been distinguished as winners.

Mixed Farms over 200 and up to 1,280 acres.

Order of Merit.

	per cent. of points.
Worboys T. C.	91·18
Wilford W. H.	90·31
Warden A. F.	88·22
Mason Dr. H. W.	87·36
Godfrey G., senior	86·73
Sommerlad J. H....	83·26
O'Meara W.	79·77

George Godfrey, senr., Gocup, 13 miles from Gundagai.

South Tableland District.—Place, No. 5 ; points, 86·73 per cent. ; arable, 73 acres ; pasture, 226 acres ; homestead, 1¾ acre ; orchard, ¼ acre ; total, 300 acres.

(10 October, 1893.)

Mr. Godfrey's farm occupies principally alluvial flats at the foot of Mount Minjary, between Gundagai and Tumut, and comprises 60 acres of reclaimed marsh, devoted to cultivation; 30 acres of gentle hill slopes, suitable for ploughing, with a thin but fair basaltic soil, and 210 acres of steep mountain, useful for pasture only—in all, 300 acres. High ranges at the back shelter from strong winds, and their soakage supplies the stream that made in days gone by the marsh. The main Gundagai-Tumut road passes through the property, the first-named place being 13 miles distant and Tumut 8 miles. The haulage to Gundagai railway station is moderately heavy, some steep hills having to be surmounted. Many years ago, in the gold-mining period,

* See tables, page 99.

before the days of the railroad, the Tumut district sent produce to Albury, Lambing Flat (Young), and other distant centres, but the rail has altered matters, besides which these places now supply their own wants. The Tumut market to-day is distinctively a local and district one, and the farmers are looking out for other centres and for other methods of disposal than now exist.

Mr. Godfrey is a native of Bedfordshire, England, and had some experience in agricultural labour prior to emigrating. He had made and laid pipe-drains, and had seen the great drainage system of the Fen country of Lincolnshire, and this influenced him in taking up a discarded marshy spot. Thirty years ago, dating from February, 1894, he paid £230 for the goodwill and improvements on a selection of 160 acres, forming the nucleus of his farm. The improvements consisted of a small slab-house and a 10-acre paddock fenced, but not cleared, whilst so unpromising did the 60 acres of marsh appear that neighbours fully expected another relinquishment. The geological formation of the district is Silurian slate, backed by high granite ranges; the slate foot-hills slope at first steeply down as sharp ridges to the Tumut valley, and vary from 300 to 500 feet in elevation. They are covered with a thin soil, and the soil of the lower gentle slopes is a much weathered débris, in which disintegrated basalt forms a part. These red soils are sandy, porous, and fertile. The alluvial flats have much of this red soil with layers of clay and slaty débris. The marsh is caused by an upper layer of tenacious clay, beneath which the soakage finds a way through the porous red soil, and bursts up through the clay as treacherous crab-hole springs, into which many oxen sank when numerous teams used to camp in the olden days. The marsh was then a bog of black peat, and tall impenetrable masses of reeds.

Drainage was the first consideration, and begun by digging a main ditch at the junction of the marsh with the hill slopes, so that the soakage might be tapped. Trenches 3 feet deep were next cut across the marsh, and draining into the main ditch. So rough was the coarse reed foliage and sour grass tussocks that it was necessary to mow a way through them prior to cutting the trench. The crab holes were attacked by a special trench, the bottom of which was filled in with rough slabs, forming underground drains that act as well to-day as they did thirty years ago. Year by year more and more of the marsh has been reclaimed, first by the labour of Mr. Godfrey alone, and then assisted for a few years past by his two sons. A small final portion awaits treatment, and shows to-day what the original condition must have been. After drainage the soil becomes a light-working, black, sandy loam, lying 3 feet above the level of the running ditches, so that there is always capillary moisture, but after wet the land poaches freely wherever troddened; if turned up wet the clods remain for a long time hard-baked, which precludes a fine even tilth, but the growth of the crop is not interfered with. Rain-water is conserved in an underground tank for household purposes, and there are natural supplies of water in most of the paddocks. The farm, moreover, affords a lesson in practical irrigation, for by temporarily blocking the main ditch the water can be thrown up into shallow channels that command the lower levels of the flat, and by this means crops of maize have been irrigated in trying seasons. The same can also be extended to the orchard and vegetable garden.

The fences throughout are serviceable and good, being two and three rail, two wire and three rail, also one wire and three rail, the wire being added to strengthen fences weakened by age. There are some gates, and existing slip-rails will give place to gates as circumstances allow.

The residence is of red brick, containing seven rooms, and was built ten years ago at an outlay of £650. The kitchen is separate, and of equal date. In front there is a small flower garden, and at a little distance a moderate-sized orchard and kitchen garden. The farm buildings are arranged to afford every convenience for working, and are distributed apart to avoid any risk of fire. They are throughout of slabs, with round timbers, and roofed with iron or bark. The barn, 60 feet by 20 feet, is occupied as an oaten hay store, and in it are many machines worked by horse-gear outside. There are also a cart and implement shed, tool-shop, store-room, calf-pen, and milking yard, new five-stall stable of superior finish, the old stable, piggery and yard, double stockyard and windlass.

The implements comprise two one-furrow ploughs by Ransome and Howard, two-furrow plough by Howard, wheel harrow by Howard, one set of iron harrows, wood harrow for breaking down rough ground, small disc harrow for covering in seed, iron horse-hoe with various shaped feet, wood roller, maize (horse) drill, broadcast seed-sower for use on a cart, Robinson's of Melbourne back delivery mower, Hornsby's string binder, two drays, and a buggy. In the barn the following are driven by shafting from a Bentall's horse-gear outside: a large maize-sheller, chaff-cutter, and grindstone. Mr. Godfrey attends to his own repairs, and has a tool-shop well supplied. The selection of implements is good, and they are properly cared for.

The cultivation of the farm is as follows:—Sixteen acres of oats and wheat mixed for hay on a once heavily-timbered flat, 15 acres of late sown oats for hay on the original marsh, 2 acres of minor crops, such as 1 acre of maize, ¼ acre potatoes, ½ acre millet, melons, and amber cane, and ¼ acre of pumpkins in odd pieces of land. Two acres of "Chevalier" malting barley has been sown as an experiment, the seed being obtained from Mr. Coker, of Cootamundra, and 10 acres of maize—in all, 45 acres of cultivated land. On the fallows grass is allowed to grow for a short period, and 12 acres are due for wheat, and 15 acres for maize next season—in all, there are 27 acres of this pasture. The natural herbage of the nearly cleared slopes and hillsides amounts to 226 acres, and a portion has been under cultivation during past years. The total area of the farm is 300 acres, of which 72 acres may be classed as arable. The rotation is based upon wheat after a fallow followed by hay—oaten or wheaten. The object of the fallow is to clean the land every third year, but on the 60 acres of alluvial flat it is only introduced when the land really wants cleaning, otherwise maize is followed by hay continuously. The land is prepared for wheat and hay by one main ploughing, the seed is broadcasted, harrowed in, rolled in spring, and harvested by a string binder, carried to the hay-shed, or stacked at the homestead. The wheat is thrashed at 1s. per bag by a travelling 8-horse pegdrum machine, the owner of the thrasher supplying horses, feeder, and driver, whilst extra hands and rations for the whole are supplied by the farmer. A steam tackle would do in one day all the wheat grown on a small farm, and there are one or two sets in the district. A small area of potatoes and pumpkins are grown for home consumption, and the surplus is sold locally.

Land for maize receives one main ploughing, and the employment of harrow and scuffle to bring it to a fine tilth with the further use of Howard's wheel harrow as the best tool, in Mr. Godfrey's opinion, to work up weeds and clear off rubbish. The corn is planted by the horse-drill in rows 4 feet apart, the varieties preferred being "Horse Tooth" and "Early Profit." Constant cleaning is pursued by horse and hand hoe, particularly in the early stages of growth, and sheep are run through the crop when nearly ripe as a further cleaning process. The cobs are husked in the barn, the husks

being picked over by stock, and used for litter, and the cores for fuel. When a hay crop follows the stalks are rolled down and ploughed in or burnt off for a succeeding crop of maize. The chief weeds of the farm are sorrel and thistles, and the former is kept under by the summer fallow every third year. If in cultivating the land there be many such weeds one or two shallow ploughings are preferred. Through the neglect of neighbours and the state of the roads, thistles and briars invade Mr. Godfrey's land. The yields per acre, taking an average of many years, are as follows:—Oaten and wheaten hay on the slopes from $1\frac{3}{4}$ to 2 tons per acre, and on the alluvial $2\frac{1}{2}$ tons per acre. Wheat averages 20 bushels, with extremes of from 16 to 35 bushels per acre; maize, 50 to 60 bushels, with extremes of from 30 to 80 bushels per acre.

The making of manure is attended to by throwing maize-cores to the pigs, the gathering of yard-waste and stable-dung into one heap. In the cow-yard, straw is trodden down; poultry droppings are saved for special use in the garden; the farmyard-dung is used to equalise poor patches, and the land affords indications that a more general application is needed.

Mention has been made of the conservation of oaten and wheaten hay. Rye-grass was one year laid down and ploughed up since then. No artificial grasses have been sown, but rye-grass is still to be met with in the pastures. The natural grasses are nutritious, and give good feed to the sheep on the steep hill-sides, which extend over an area of 226 acres.

The live-stock comprise 15 horses, 36 cattle, 150 sheep, 15 swine, and 100 head of poultry. The eight farm-horses are of a good active type, and two are young draught horses coming on into work. There is also a pair of well-bred buggy-horses, 2 saddle-horses, and 3 young light horses. The milch-cows number 9—springers, 6; yearlings, 5; calves, 15; and a bull; total, 36,—the whole forming a useful type, in which Durham predominates. The sheep are breeding-ewes, chiefly merino, and a few cross-bred, a flock being kept for grazing surplus feed. Bacon is cured for home use, and live pigs sold. The stock comprises a Berkshire boar, 2 sows, and 12 young pigs. The poultry were of mixed breeds.

The kitchen garden and fruit-trees merely supply sufficient for home requirements, save a few apples and quinces are sold.

Bookkeeping consisted in a record of sales and purchases.

A small quantity of experimental wheat was growing from seed supplied by Mr. H. D. Coker, of Cootamundra, consisting of 3 bushels of Smith's "Nonpareil," 1 bushel of "Lambrigg," and some "Allora Spring." The district is not entirely free from rust, but, unless on the alluvial flat, it is not a great evil. When it was profitable to grow tobacco a few years ago, some 10 acres of the alluvial flat was let off to Chinamen, who produced several tons. A little amber cane is being tried this season.

The subsidiary aids may be enumerated as co-operative family labour,—Mrs. and the two Miss Godfreys attending to the dairy, including milking and butter-making, as well as the poultry; use of flour from home-grown wheat; letting out of the string-binder (£25 per annum being so earned); home repairs, carpentering, and engineering; the keeping of a produce store on the main roadside; salt meat, also bacon and hams cured for home use; sales of 10 lb of butter per week, apples, quinces, and potatoes.

The points of interest are the drainage of a marsh, extensive growth of hay crops, and sales of produce through channels attached to the farm.

The general management, with a view to profit, has been to grow horse-feed for local sale, there being a produce-store on the farm, and a son-in-law established as a produce-dealer in Tumut, so that a safe outlet is secured for

this particular farm. The 60 acres of alluvial form the chief cultivation area. The arable land is cropped on a three years rotation, viz., a grain crop, a hay crop, and a rest as pasture. The work of the farm is done by two men, eight horses, and a good selection of implements. The cattle are evidently the least profitable of the live-stock when their present low values are considered, whilst the flock of sheep kept to clear off surplus feed might be increased in numbers. Poultry and swine pay well. Two horses are sold on an average each year, and young cattle as occasion offers. The prices got are as follows:—Hay, £3 10s. per ton; maize, 2s. 9d. to 3s. per bushel; wheat, 3s. per bushel; feed oats, 3s. per bushel; hay chaff, £4 per ton. The annual turnover amounts to £270, to which must be added the household expenses of five adults and improvements added to the farm. The original capital of £230 was spent in the purchase of the goodwill of the original selection, and only the balance of certain payments are now owing to the State. The improvements, buildings, live-stock, and farming plant may be taken at £3,000, and a family of ten, including the parents, have been supported by the farm amidst every comfort. The results of Mr. Godfrey's farming may be summarised as the building up of an occupation well fenced, drained, and cultivated, with good serviceable buildings and a neat homestead, by means of his own labour, assisted of late years by his sons.

Dr. H. Wharton Mason, Tumut.

South Tableland District.—Place, No. 4; points, 87·36 per cent.; arable, 219 acres; pasture, 228 acres; forest, 320 acres; orchard, 3½ acres; homestead, 2 acres; total, 772 acres.

(11 October, 1893.)

Dr. Mason has entered upon farming as an investment, finding leisure, amidst a busy life, to give a general superintendence. From time to time, as opportunity occurred, freehold areas have been purchased on the rich alluvial flats within a mile or two of Tumut. On these fertile lands, subject to overflows which replenish the soil by the deposition of silt, continuous crops of maize, pumpkins, and cereal hay are grown, and when the market again proves favourable a large area is ready to be planted with tobacco. Quite recently, 400 tons of leaf were stored in Tumut awaiting sale, but the excise duty is blamed for manufacturers nominally preferring American tobaccos, although it is suspected that stocks of Colonial leaf, acquired at depreciated rates, enter largely into their output. The great art of tobacco-making lies in the management of the curing-shed, and, in the opinion of Mr. Sutherland, the expert of the Department of Agriculture, the Tumut soil will grow good plants, but something more than the open Chinese pattern of shed is needed. Hitherto, the growth of tobacco has been in the hands of Chinese, who can seldom be induced to alter their traditions of cultivation. Their ways of curing lead to inferiority, and the large accumulations of leaf came from their sheds. Their methods of intense cultivation depend on well-watered, fertile lands, and, in their competition for such, landlords who hold Tumut alluvials have reaped much benefit; in fact, it is a question whether altogether too high a rental is not entertained, and large areas are kept in pasture, which, if rents were lower, could be readily leased. To-day the Tumut tobacco industry may be said not to exist, for disease has well nigh exterminated the seedling plants, although spraying affords a remedy not yet availed of. Dr. Mason is, however, prepared to grow and cure tobacco whenever the product can be sold at a profit, or when co-operative support is given to a proper curing-shed.

The local demand for maize is limited, and further efforts are needed to open up markets in the south-eastern districts of the Colony. The Sydney market can only be reached by 285 miles of railway carriage, and is availed of if prices are favourable, Dr. Mason and other growers having made top prices for picked samples. The doctor is, however, prepared to fall back on fattening swine in conjunction with his butter-factory. The establishment of a complete cheese and separating plant, worked by water-power, was due to the necessity of most profitably utilising the food which the rich alluvials are capable of growing. In order to do so, a dairy herd is being established which will yield the maximum of rich milk, but it takes great skill and years of culling to bring about an ideal result. The cows and swine together will absorb what food can be produced. Oaten and wheaten hay is being largely grown, and, by ensilage, stores of green stuff are to be rendered available, particularly when the crop is compounded of vetches and oats, with beans and peas, as is proposed. It is a feature of this farm that large supplies of fodder can be relied on, and it is important that storage in stack or silo be made for summer use. Perhaps no climate and soil can be better suited for this scheme of farming.

The Tumut Valley has been scoured out of the soft Silurian slates during the course of ages. On either side high granite ranges hem in the slate formation, and the detritus washed down from an extensive watershed has formed the fertile alluvial flats. Hydraulic mining is yearly sending down a vast bulk of silt, so that lagoons are filled up, meadows raised, and fences disappear. Gilmore Creek bounds one of Dr. Mason's farms, and silt from this source can be laid at will on many of the pastures. Bumbowlee Creek passes through another farm, but its silt is derived from natural sources. There are four distinct farms lying at a little distance from each other. The acreage of the Bumbowlee Creek farm is 109½, consisting of 28 acres of oaten-hay land, 52 acres of tobacco flat, and 29½ acres of hill-slope grazing country; it was purchased five years ago. On the Tumut River there are 17½ acres, all alluvial flat, and including an orchard of 3½ acres, and purchased two years ago. Another area on the Tumut River extends over 125 acres of alluvial, devoted to the growth of maize. The largest farm is Gilmore Creek, where the head-quarters are. It comprises 200 acres of flat and 300 acres of hillslope recently ringbarked. In all, there are 772 acres, composed of 219 acres arable, 230 acres pasture, 3½ acres orchard, and 320 acres forest.

The large proportion of alluvial land, nearly 400 acres, is subject to overflow, and where the land recedes from the high banks next the streams, flood-waters may lie for a time and form some permanently wet pastures and some lagoons. In the aggregate a great many acres have been surface-drained by long contour plough-furrows, and by deeper ditches. By similar methods other areas have been laid under waters of irrigation, so that both drainage and irrigation have been attended to.

Through having bought from time to time contiguous small properties, the fences proved too numerous, and many divisions have been thrown into one, so that larger areas may be ploughed. In all cases the fences were in good order, and instead of burning off timber from the forest land a large supply of posts and rails has been got out. Moreover, in slack times the dead timber is to be drawn to the saw-mill and cut for town fuel supply. The roadways across the alluvial flats have entailed much attention to render them dry, and many wet spots have cost money to make passable.

Another feature of buying up small farms is that each had its homestead. The farm buildings at Bumbowlee Creek were not long ago destroyed by fire,

but a fair-sized farm cottage is in good order and tenanted. On the orchard plot on the Tumut River there is a superior four-room cottage, occupied by one of the hands. The barn, 40 feet by 20 feet, is of horizontal saplings with iron roof, and may be used for tobacco-curing. There is a similarly-constructed shed 40 feet by 8 feet for corn, as well as a windlass and yard. On the tobacco-grounds of the Tumut River property there are numerous but inferior dwelling-places occupied by previous Chinese tenants, and now by permanent or temporary hands. Two specially-constructed tobacco-sheds ave been put up, open on all sides, with round posts and iron roof, the argest measuring 200 feet by 30 feet by 18 feet high, and costing £120 and £250 respectively. The plan was on the best local system, but Mr. Sutherland, the tobacco expert, points out that quality of leaf cannot be cured without proper control of ventilation and the regulation of heat, which might be secured by double walls and a ceiling. The main homestead is at Gilmore Creek, where an old flour-mill has been adapted to a dairy, and the water-wheel repaired at a cost of £80 for woodwork alone. By this means 10-horse power is utilised for the butter factory, food-preparing machinery, and saw-bench. The miller's cottage is occupied by the butter-maker, and a large iron-roofed shed 170 feet by 40 feet gives accommodation to 32 milking-bails, and as many cows can be housed in winter, barn storage for hay and maize, chaff-cutting appliances and implement shelter. A piggery adjoining, 40 feet by 25 feet, contains 8 breeding-pens, and the surrounding paddock of 14 acres is about to be made pig-proof.

The implements comprise 7 one-furrow ploughs, horse-hoes, and 4 scarifiers, including the "Planet," 6 harrows, and roller and corn-rake, Howard's string-binder and reaper, 2 maize-shellers, Hunt's large chaff-cutter and corn-cracker, elevator and chaff-bagger, 90-gallon Alexandra separator, Kiama 80-lb. churn, Helical butter-worker, complete cheese plant by Zingel of Kiama, 2 large coppers for heating water, fan to butter cool-store, rotatory pump and hose in case of fire driven by the 10-horse power water-wheel, circular saw bench, blacksmith's forge and tools for general repairs (heavy repairs done by tradespeople), 1 3-horse waggon, 2 drays.

The system upon which Dr. Mason farms is, to grow maize and oaten hay with a summer rest, stock running on the stubbles. Clover springs up luxuriantly, and constitutes the nitrogen-gathering legume on these stubbles. For instance, at Bumbowlee, the oaten hay of the previous season was put up in five circular stacks, said to be the first in the district. On reaping, a good deal of grain was shattered, which, however, afforded a luxuriant feed to 130 head of dairy stock, who were grazing preparatory to the land being planted with maize. At theTumut River farm 125 acres were to be in maize this season; the land ploughed up well, clover having grown thickly, with a good sprinkling of ranunculus. The maize crop immediately preceding gave an increased yield, as a result of constant horse and hand hoeing, the "Planet" cultivator giving much satisfaction. These lands are subject to overflow, and the silt deposited replenishes fertility, so that no rotation is necessary. Wheat grows too luxuriantly on these alluvials, so oats are preferred for hay. Throughout the maize, pumpkins are grown for pig and cattle food, and every effort is made to secure thorough and clean cultivation. The character of the corn and hay produced is excellent.

The value of manure is recognised on this farm. Nightsoil is delivered by the town authorities; from the piggeries and cow-yards a large quantity of dung is gathered; several tons of bones, a legacy left by a previous butcher tenant, are about to be rendered friable with quicklime, and a deposit of silt can be put at will over large areas. In a dairy farm manure is distributed

by the grazing stock, and in order to accumulate dung it is intended to winter sixty head on the Gilmore farm steading.

On a farm where such large quantities of fodder are conserved, ample accommodation is provided in the great tobacco-sheds on the Tumut River farm, in the barn at the orchard, in the great shed at Gilmore Creek, and in the five round stacks at Bumbowlee. The Howard's string-binder cuts the crops, and at Gilmore a large chaff-cutter driven by water-power prepares food for the stock. The previous year some silage had been successfully made on a plan suggested by Mr. Argyle M'Callum, of Yass, whereby ordinary fencing-wire is utilised, and the pressure applied by a miniature windless on each strand. The drum is made out of round timber 18 inches long by 6 inches in diameter. Through an auger-hole in the centre the wire is passed, and one turn, given by handles through holes at each end, causes the wire to take two laps. So simple and inexpensive is this plan that no farm should be without a silage stack. Some 14 acres of the Gilmore flat are to be put into lucerne and sorghum.

No system of laying down grass has been attempted, because rye-grass and clover have taken such hold on the flats that the result cannot be improved. It is worthy of notice that grass seeds have been scattered on poor leas, and special pains have been taken to keep the pasture lands dry, level, and healthy, by means of ditches, plough-furrows, and silting.

The 30 acres of hill slope at Bumbowlee were covered with a rich growth of natural grass, in which there was a sprinkling of natural-sown rye-grass, working its way up from the flats, where, with clover, it formed a luxuriant growth. The pastures at Gilmore, extending over 200 acres, were devoted to the dairy herd. One area recently acquired had once been under the plough, and, from close-feeding, showed poor pasture; it is to be cropped again after dressing with nightsoil and bones. An adjoining pasture of 16 acres is to be cut for silage, and then its low levels silted up. Another pasture adjoining of 42 acres, that has to be grazed bare, is to be rested, and then cut for silage, to be followed by a grass-hay crop, and kept for summer-grazing. A 4-acre paddock next the dairy is to be heavily manured, sown with tares, oats, peas, and beans for ensilage, then silted and put into green barley, as it is handy for feeding the cows. The forest country of 300 acres on the Gilmore Creek property, occupying slate foothills, is fenced off from the 200 acres of flat, and was rung eighteen months ago. On it the horse stock are run, and young cattle turned out to pick up their living, the unremunerativeness of cattle rendering such a cheap method necessary.

The live stock number 50 horses, 309 cattle, 60 swine, and 66 head of poultry. The 50 horses comprise 36 thoroughbred, for which Dr. Mason has a partiality, and several beauties are to be found, also mixed carriage and saddle horses. They are well looked after, and sales add to the annual turnover. There are 14 plough-horses, of a good active type.

The key to Dr. Mason's system of farming is the keeping of dairy stock to utilise the luxuriant yields of pasture, fodder, and maize on the alluvial flats. Since profit on dairying depends on the milk-yield, an initial difficulty had to be met of building up a profitable dairy herd. The average Tumut cattle are of mixed origin, with Durham predominating, chiefly of the very best beef type, but no systematic improvement of the milking qualities has been attempted. It takes years to collect a good milking herd; heifers from full milkers have to be tested, and young and old rigorously culled; and, above all, the influence of the sire is paramount. Dr. Mason has ever been ready to buy up small dairy herds and individual good milkers; recently he

acquired 60 head from a neighbouring dairy-farm. In order to introduce a Jersey element, he is forming a pure-bred herd. The bull, "Neat Boy's Pride," was procured from the Wood-Mason herd of Victoria, and 10 cows from the Wallace strain. The bull has had several months service with 60 cows of the main dairy herd, and already his influence is being shown, and there are 4 pure-bred calves of great promise. The Jerseys number in all 15 head. The ordinary stock comprise 3 bulls, 65 cows in milk, 105 springers, fosters and dry, 70 yearlings up to two years, and 51 calves up to four months, making a total of 309 head. The three bulls are of first-class Durham type, being from McIntyre of Wagga Wagga, and amongst the cows Durham predominates. All were in a very healthy condition. The disposal of the culls, fats, yearlings, and calves is a perplexity since prices rule low—£1 for an 18-month-old animal that has eaten food to four times that value; and, in fact, it is cheaper to kill a calf at birth for pig-food than to rear it. Calves are assisted with skim-milk, and when weaned are sent to pick up a living on the forest hill-land. No sheep are kept, but it is a question whether it would not be wiser to discard all male cattle at birth and run sheep in lieu on the forest land. Wool always commands a value, and the Tumut district ought to turn out superior "freezers" for export. The chief want is a freezing-works on the main railway line, which would benefit many other districts besides Tumut.

The keeping of swine is closely allied with dairying, and Dr. Mason has made preparations on an extensive scale. The neucleus of the herd is Berkshire, there being 3 boars, 15 breeding-sows, and 42 young pigs. Large piggeries, paddocks (14 acres), and food-preparing plant are at hand, and the enormous bulk of maize and lucerne that can be produced should render the enterprise most profitable. A few head of poultry are kept—6 turkeys, 20 ducks, and 40 fowls.

A few vegetables are grown for home use, but no feature is made of gardening. The orchard of 3½ acres was full of strong, growing, thriving trees, but the previous tenants were Chinese, and therefore no attention had been paid to pruning and general orchard work.

The books of account contained records of sales and purchases from the first, and indicate that at least £9,000 had been invested. Proper books relating to the dairy branch were kept by the man in charge. The labour of the farm was wholly hired. There was a farm superintendent and a dairy manager, whilst extra labour is easily got at the rate of £1 per week, board and lodging provided. The average number employed is from two to four, and three milkers are expected to strip twenty cows each.

As a subsidiary aid the dairy stands prominent. The purchase of the mill, repair of the water-wheel, erection of the enormous shed, fitting up of a 90-gallon separator plant, obtaining a set of cheese appliances, and securing the services of a competent manager have entailed a large outlay. The appliances are ready to deal with milk of 200 cows, but the opportunity offered to the farmers of the district has not been realised. The sixty-four cows in milk in October would be rapidly supplemented as summer is entered upon. A retail milk trade was conducted, with two deliveries daily, and 3d. per quart charged, but it is customary for families to keep their own cows, so that there is only a limited field for town supply. The market for the butter lies west, and the storekeepers of the Darling will have to be enlisted in its distribution. Tumut lies off the railway line like an oasis, and whilst distance militates against Sydney as a market for its products, the same is a factor in its favour when the Riverina and western trade is considered. There should be no difficulty in making a market for

good butter, bacon, and cheese. Cheese-making had not been entered upon, but a small plant had been purchased. Bacon-curing had also to be commenced. Tobacco-culture has been fully noticed, and when the difficulty of proper curing is overcome the yield from these choice alluvials should prove very remunerative.

The points of interest may be summarised as drainage, irrigation, and silting, extended oaten-hay production, and tobacco-culture when the market is profitable; the foundation of a large dairy herd and the introduction of Jerseys, the establishment of a butter factory, and provision made for pig-rearing on a large scale; also the growth and conservation of fodder by barn, stack, and ensilage.

The general management, with a view to profit, is based upon getting the fullest supply of produce from rich alluvial land and marketing it by means of butter, bacon, and cheese. The situation of Tumut is favourable for the supply of such to Riverina and western markets, whilst the distance from Sydney necessitates other distributing centres being relied on. The enterprise is so great as to need undivided attention, and the skill shown by Dr. Mason in planning it warrants the firmest hope in its ultimate success.

T. C. Worboys, Wattle Grove Farm, Spring Hill, near Orange.

South Tableland District.—Champion Prize Farm; points, 91·18 per cent.; arable, 170 acres; pasture (fallow ridge) 61 acres; homestead and orchard, 5 acres; total, 236 acres.

(21 October, 1893.)

Wattle Grove Farm is distant 1½ miles from Spring Hill Station, on the Western Line, and 11 miles from Orange. The land has a gentle slope towards the south, over the higher portion, but the larger area is very nearly level, and in one part it lies somewhat low. The climate of this farm, which stands 3,086 feet above sea-level, is at times during the winter very bleak. The westerly winds in spring are searching; hot winds, however, seldom prevail, and misty rain is pretty regular throughout the year. Spring is later than in the coastal districts, and the dry westerly winds, with absence of rain which prevailed just prior to my visit, began to tell upon the vegetation. The country rock was evidently slate, here and there appearing in hills of low elevation, but overlaid with detritus from the disintregation of the great basaltic overflow which geologists consider to have burst forth long ages ago from the Canoblas, whose high hills are distant about 12 miles. The soil is of a light red tint, and of a sandy, friable texture, fit to work in all weathers, and the growth of clover showing it to be of natural fertility. In the lower levels, where the basalt cap has been denuded and slate rock disintregated, a resulting white clay is deposited, forming a sandy clay soil, which, if drained, works freely, but holds the water otherwise. The fertility of these soils quickly falls off, so that a rest or a good rotation is necessary. If manured, the improvement is magical, and increased returns most satisfactory. In 1863, when Mr. Worboys took up his selection, the Western Line extended only as far as Raglan, a few houses constituted the township of Orange, and it took three days to cart wheat from Springhill to Bathurst, the market-town of the district. Immediately before Mr. Worboys selected this farm, he was camped with Mr. W. H. Newman on land that the next day was worked as the first and richest claim on the Lucknow gold-field. The excitement was great, and it was a question whether he should pay £1 for a mining claim or take up a selection. Having had six years of mining with varied success, the settled life of a farmer proved the more attractive.

Sir John Robertson's Land Act was then in its early days, and with a knowledge of farming gained when as a boy he worked on an English farm, the choice was made, but he had no money. With skill as a miner, contracts were undertaken to sink wells, and at the end of six months' time he became the possessor of £25 5s. The gold was paid as a quarter-deposit on a 100-acre selection, and the 5s. remained as working capital. Mr. Worboys had necessarily to sell his labour, and by dint of hard work in many contracts, either well-sinking or clearing land, kept himself, and at intervals cleared portions of his forest land. Little by little larger breadths of wheat were got in, a house of turf put up, a well 70 feet deep sunk, and the grain was sold in Bathurst, a week being occupied going there and back. This slow progress continued for six years, and it occurred to him that as there was only one steam thrasher in the district, money might be made if the possession of one could be but financed. The matter was laid before Messrs. Dalton, of Orange, who, reading the honesty of the man, agreed to supply an 8-horse power set of Hornsby's finishing steam tackle, costing £810. In the first season (1874) it earned a large sum, and in three years the whole debt was paid. Other improved implements were got on similar terms, additional forest land cleared, and more wheat grown. The year 1882 was exceptionably favourable to the Orange district. Elsewhere drought prevailed, so that wheat and hay which did well that season sold dearly, and this farm of less than 100 acres returned more than £1,200 for wheat alone. The next two years were also favourable, and as an outcome, instead of banking the money, the present substantial brick residence was erected, at a cost of £900. Previous to that, however, an adjoining 136 acres of land was bought, at a cost of £725, thereby raising the area to 236 acres. The result of thirty years' farming, starting with a capital of £25 5s., has been the acquiring of 236 acres of land, the possession of implements costing £1,400, the erection of a residence at about £1,000, and farm buildings representing £700, which, with live stock, crops, and improvements, brings the total moneys invested up to near £6,000. Is it not apparent that the choice made on Lucknow thirty years ago was a wise one? Drainage is not necessary on the light red hill soils, but where clay prevails it will have to be done, and on the white clay bottoms open ditches have improved wet spots. There is a dam in the horse-paddock, and another in a more distant part of the farm Rain-water is conserved for household use in a large underground cistern, and pumped to a supply tank, so that it is laid on to the house. In the farm-yard there is a large underground tank for the live-stock. The character of the fencing is, from a practical standpoint, good in that instead of burning off the timber it has been drawn to a neat chock-and-log fence until required for fuel. In a cold climate much wood is used for household purposes, besides the demand of the steam-engine. The exterior and roadside fences are being replaced with one of seven wires and no top rail, to be ultimately planted with whitethorn. Leading to the homestead are many fences of whitethorn and African buckthorn, clipped twice a year, and kept exceedingly neat, giving an appearance like unto an English farm. Gates have wholly replaced slip-rails, and posts and rails of unusual strength divided the three yards of the homestead. There are nine paddocks, varying from 6 to 50 acres in extent. The residence contains ten rooms, and is built of bricks made on the spot, at a cost of 30s. per 1,000, and is situated in a small enclosure, portioned off into a flower and kitchen garden. The design of the house was made by Mr. Worboys, who studied having every convenience, water being laid on and every room built with a fire-place. The farm steading comprises numerous detached buildings, standing in a quadrangle,

with three large well-fenced yards, and typical of what a homestead should be. The wheat-store or granary is of stone, with iron roof, 45 ft. x 30 ft.; in it the wheat-dressing implements are placed, a bacon smoke-chamber and sleeping-rooms for two men. The large barn is 66 ft. x 35 ft., built of wood with a thatched roof, recently replaced by Mr. Worboys' own hands. To have covered it with iron would have cost £60, whereas £6 represented the outlay for rethatching. An older thatched building is the stable, and after twenty years' service its roof awaits recovering. Of course there is danger from fire and sparks from the steam-engine, but greater care is therefore exercised. The implements are stored under a large iron shed, but it cannot accommodate all the extensive collection. In a wing is placed the blacksmith's shop and tools, in the use of which Mr. Worboys and his sons are adepts. The milking-shed contains six bails, a continuous galvanised-iron trough for feeding at the head, and a yard where litter is trodden into farm-yard manure. The wheat-sheaves are carted direct from the field to the thrashing machine, which is so placed that the cavings are delivered into the barn for use as feed, &c. The straw is stacked to be used for litter and made into manure, the yield being about 15 cwt. per acre, worth 1s. 6d. per cwt.

The implements are an extensive collection, and comprise the 8-horse power finishing thrashing set (Hornsby, Marshall's straw elevator); two 1-furrow, two 2-furrow, one 3-furrow, and one 6-furrow ploughs, the latter by Hudson, proving a useful tool for rapid light work; disc harrow (Howard), the fore carriage of which is much approved; several sets of iron harrows; heavy cultivator (Ball); horse-hoe (Carson and Toone); Farmer's Friend wheat-drill, of Canadian make; Dobie's broadcast machine, to fix on a cart; 9-foot iron roller; horse-rake (Ashby); corn-sheller; two winnowers; rotatory corn-screen (Hornsby); corn-cracker (Hunt); chaff-cutter, for green stuff (Bentall); corn-sheller; trolly; two drays; spring-cart and buggy; three string-binders (Wood); large steam chaff-cutter and bagger, by Melhuish, of Springhill, and fitted with patent bagging plungers, which pack the chaff tight and do not clog; also saw-bench for cutting firewood. It is estimated that £1,400 would not cover the cost of the above. This collection is far beyond that usually deemed necessary for a 236-acre farm, but Mr. Worboys has made the more expensive outlays to earn their cost by working for hire, besides which the use of improved tools has lightened to a very great extent the laborious work of the farm.

A three-course rotation has been adopted, consisting of wheat, hay, and potatoes, or roots, or a fallow the third year. When the land is allowed to rest, a luxuriant growth of white clover quickly springs up, and by its nitrogen-gathering power restores fertility. Weeds in this elevated district are not so troublesome as where an earlier spring prevails; the crops, as well as the fences and headlands, were kept clean, and thorough preparation of a seed-bed is aimed at before sowing. The ploughing is got over early in the winter, and the first weeds of spring are worked out by cross-cultivation with a 6-furrow implement, of Hudson's make, having mould-boards without sides or slides, and giving a satisfactory pulverising result. Wheat for grain is put in by the horse-drill during April and May, whilst oats or wheat for hay are broadcasted by the machine. The winter growth of wheat induces plentiful tillering; in fact, one paddock, being too proud this season, was eaten close down by pigs, and rust is avoided by early maturity, although later crops are subject to it. The grain and hay are cut by string-binders, the former being stooked in shooks of ten for a fortnight, so as to mellow, and they are carried direct to the steam

thrasher. The cavings are stored in the barn for feed at home, and the straw is stacked outside and thatched. The grain is chiefly sold to the co-operative mill at Millthorpe, of which Mr. Worboys is a director, and he looks with pride upon the continuous good dividends (20 per cent.) it has paid. The market is carefully watched, and the grain is stored in the large granary, it being of very great advantage to a farmer to hold for a favourable turn, rather than rush a crop upon an adverse market.

The cropping this year is as follows:—Wheat, 52 acres; wheaten hay, 65 acres; oats, for grain, 12 acres; potatoes, 25 acres; peas, 4 acres; experimental wheats, 9 acres; turnips, 3 acres—total, 161 acres, cultivated. Pasture and fallow, 51 acres; waste ridge and stony ground, 10 acres; orchards and homestead, 5 acres. Total, 236 acres. The principal wheats grown are Talavera, Purple Straw, Blount's, and Lambrigg. No less than 9 acres were cropped with experimental wheats, 180 varieties being grown side by side, and affording an object-lesson of unusual interest. Especial care was taken in sowing, in keeping the drills clean, and the greatest accuracy will be necessary in harvesting, tying the yields up separately, and in weighing the results. The 180 varieties under trial were all sown in May, on a gently-sloping, friable, red, basaltic soil. The seed was drilled, and the plots extended according to the supply of seed, which varied from 1 bushel down to 2 oz. In order to subject cross-fertilised wheats to rust, they were planted late, and in rows alternating with rows of Steinwedel, which is sure to get rust, and, therefore, would subject the new wheats produced by Dr. Cobb to contamination. If the test is safely passed, then the wheat may be classed as rust-resistant, but the miller's value of the berry may yet indicate an unsuitable sort to grow on a large scale. Each variety possessed its own type of flag, height of growth, and luxuriance. Some were earlier than others, and all tillered more or less. Length of straw is no criterion of the quality or yield of grain, and the shortness of the straw of crossbred wheats was noticeable, whilst they excelled in length of ear and number of berries, the energy of the plant appearing to spend itself in grain. The use of the Sugar Company's No. 3 fertiliser greatly increased the yield last year, and now sulphate of ammonia is being tried. It would be wise for every farmer to conduct similar experiments, may be on a smaller scale, and with all classes of the plants cultivated, in order that something may be learnt, and whilst change of seed from a colder to a warmer clime is a cardinal feature of good farming, the successful experimentalist may look forward to opening up new lines of business in selected seed. Last year (1892) 34 acres of wheat gave 850 bushels, equal to 25 bushels per acre, selling at 3s. 3d. per bushel. This year 52 acres have been planted for grain. The most nutritious hay is made from wheat (bearded wheat with its solid stem makes the best). Last year 36 acres yielded 59 tons, which sold at £3 10s. per ton in the railway truck. This year 65 acres have been sown for hay. The cost of chaffing, bags, and delivery amounts to £1 7s. 6d. per ton, which, deducted from £3 10s., the selling price, leaves a profit of £2 2s. 6d. per ton. Oaten hay sells at the same price, and 20 acres gave 40 tons. This year 12 acres of oats are for grain.

Potatoes do well, and last year 15 acres yielded 60 tons, which sold at an average of £3 5s. on the truck. "Brownell's Beauty" is preferred, and "Sir Hercules" highly approved. The sets are dropped in one of the furrows after the three-furrow implement, then harrowed over, kept clean during growth, and are allowed to harden in the ground, the danger of frost being watched. They are dug by hand at a cost of from 6d. to 9d. per bag, the chief market being westward, and for seed in districts such as Molong, where

potatoes are early, and seed cannot be kept. Field peas last year sold at 4s. per bushel, and 4 acres gave 80 bushels, but they are chiefly used at home. This year 4 acres were being grown. One acre of white turnips last year gave 6 tons, which sold at £2 per ton. This year 3 acres have been put in, but the sale is limited.

The important question of making manure receives some attention. The large yard of the homestead was an extended dungheap, lavishly littered with straw, the treading being by horses having the run of it. The milking-yard and pig-pens were also littered with straw, the whole of that from the thrashed wheat having to be converted. The open-yard system is not to be commended as perfect, for much of the valuable ingredients is lost in the drainage of the rainwater, but the return to the soil of a portion of its annual yield is to be noted, and if the natural clover growth on the fallows were extended over a year, and sheep kept to feed it off, doubtless no small benefit would accrue.

Fodder is conserved as wheaten and oaten hay, pasture hay is not made, nor is ensilage attempted. Great economy is effected by using for feed chaff and cavings from the wheat threshing.

No system of laying down grasses is pursued, save the spontaneous growth of white clover on the red soils during the rest year of fallow; this is of itself a valuable feature, but on soils which do not encourage its natural growth some grasses might be sown.

The livestock comprise the following:—Sixteen horses, 12 cattle, 5 swine, and 100 head of poultry. The horses numbered 10 farm, 1 saddle, 2 buggy, and 3 cart foals; in all, 16. The heavy draught horses were of an active farm type in excellent condition, particularly kindly and free to handle. Seven milk cows are kept, and a sale is made of surplus butter amounting to 10 lb. per week. The morning's milk alone is taken, the calves running with their mothers during the day. The rations given are green barley chaff, cavings, and a general pick-up. The dairy is in a room off the residence. Sheep are bought at Christmas and sold before winter to consume the autumn growth on the stubbles and clover leas, and crossbreds are preferred, but at the time of my visit, there were no sheep on the farm, although from 50 to 100 are kept in the proper season. At this period of the year the pig stock should number 20, but the usual purchases had not been made, so only 5 were on the farm being fattened. £60 is generally realized for bacon sold, and a large quantity is consumed at home. The feed is skim-milk and peas. Poultry return for eggs, and table fowls, about £15 per annum, 100 head of mixed birds being kept, including some ducks, and the fowls pick up their living by fossicking amongst the stacks, cavings, and straw. A neatly kept flower garden and a kitchen garden of equal extent immediately by the residence sufficed for the wants of the household, all classes of vegetables growing well. The orchards, old and new, covered about 2 acres, the natural growth of clover flourished in both, but an open space was chipped around the stems. Spraying and pruning were evidently not pursued, although needed.

Bookkeeping was up to a certain extent carefully attended to, a ledger being kept, but a perfect balance sheet was not prepared. The records of sales for eight years past were interesting, and figured out a return of £4 16s. 3d. per acre cultivated, averaging 114, whilst the expenses came to £1 16s. 3d., so that a clear profit of £3 per acre was arrived at. The total sales for last year was £606. The labour of the farm is done by Mr. Worboys, his son, and one man, extra hands are hired for chaff-cutting, threshing, and extra work, the wage averaging 4s. per day. Permanent farm

hands get from 15s. to £1 per week and their board. In figuring out the cost of keep of a farm horse, including farriery, the sum of 1s. per week is regarded as covering all expenses.

The subsidiary aids comprise cöoperative family labour, sales of seed, wheat, and potatoes, bacon, butter, eggs, poultry, home repairs, and farriery.

Amongst the points of interest, various especial features have been noticed such as the storage of dead timber in fences, white thorn hedges, the fallow rest with growth of clover, the use of chaff and cavings for food, the extensive collection of machinery, and the most interesting experiments in wheat culture. On certain portions of the farm there are basalt ridges with boulders extending down the sides. During the past thirty years, a large area has been cleared of these obstacles to ploughing, and at the time of my visit more of the ridge land was being brought under cultivation. The removal of these big stones entailed heavy work. Several acres of wet clay bottom were also being drained and cleared preparatory to ploughing, so that after this year there will be a substantial addition to the arable land. One hundred golden wattles have been planted; the name of the farm indicating how that they once throve on the land.

The system of management, with a view to profit, has been to do the farm work well, and to be early with it. Neatness prevails, fences are good, weeds few, cultivation thorough, superior seeds are sown, crops are harvested by the best machinery, and markets are closely watched. This vigilance and ready resource makes farming successful whilst the true lines of family cöoperation keep down the labour bill, and utilise many of the smaller sources of profit. The farmer has need to keep ahead of the times, and when markets do not serve, others have to be opened up. The experiments conducted by Mr. Worboys in wheat will, without doubt, lead to business in choice seed wheat, for it is necessary that a change of seed be made from a colder to a warmer climate. The wheat farmer has to compete against the world, and he who can sow a superior seed producing large heads with little straw, and a berry that millers will buy, has an advantage over the less progressive farmer. The fertility of a farm has also to be sustained by improved methods, particularly in keeping up the nitrogen resources. This the natural growth of clover effects on Mr. Worboy's basaltic soils, but the poorer clays need farm-yard manure, whilst the purchase of artificial manures has been shown on this farm to leave a profit. More attention to the making of farm-yard manure is generally necessary, particularly in protection against rain whilst the ploughing in of green crops adds to the store of decomposing vegetable matter in the soil.

Alick Frederick Warden, Sunny Vale, Milton.

South Coast District.—Place, No. 3; points, 88·22 per cent.; arable, 24¾ acres; pasture, 268 acres; homestead, 4¼ acres; total, 297 acres.

[5 November, 1893.]

Mr. Warden is his own landlord, being a life tenant under his father's will, in this and other farms, which will have eventually to pass to his children. Under this proviso there is no great inducement to invest all profits in the farm, but a large sum was spent on entry, and each year many improvements are made, so that this farm may be taken to represent the very best form of tenancy.

The main coastal mountain range is distant 9 miles from the ocean, and the farm lies somewhat farther from it than the sea. The intervening

country is undulating throughout, and very broken as it approaches the mountains. Granite predominates near the ranges, and sandstone of the carboniferous age near the coast. The original vegetation was dense forest and luxuriant undergrowth, and the clearing must have been heavy work, judging from the ringbarked timber that remains in several of the paddocks. The soil is a deep brown-red, rich in vegetable matter, and lies to a depth of 3 feet on the slopes and much more so on the flats. The debris is either from a granite or basalt, boulders of which strew the soil, and weather away rapidly when exposed to damp, renewing with elements of rich fertility the land.

The farm occupies a choice site, chiefly a gentle valley with adjacent slopes and one steepish ridge forming the watershed of a small creek which rises on the estate. The westerly winds make themselves felt. A dense thicket of wattles shows how nature designs a wind break, and Mr. Warden has planted rows of trees to shelter the farm-yard. The pasture is luxuriant throughout, and leads to dairying being the main feature of the farming. Scarcity of rain, however, pinches the pasture, rendering some provision of fodder a necessity when a large dairy herd is kept. The market for the butter is Sydney, *via* Ulladulla, the shipping port, distant 6 miles, and with two boats weekly to the metropolis. The farm is 3 miles away from Milton, the local centre of population, and on either side to the north and south the country is virgin forest, whilst the high ranges at the back effectually cut off the table-land. The nearest mining centre is Nelligen, 40 miles distant. This isolation compels Sydney being made the one market.

There are no wet spots on the farm, and the porosity of the soil renders underground drainage unnecessary. Water conservation might take the form of a dam that could be constructed at a spot to command many acres with waters of irrigation. The creek is thrown back at intervals with dams which afford crossing roads for cattle to and from the milking yards, whose many feet as it is cut deep tracks into the pastures. There are also water-holes on some of the paddocks. Rain-water is conserved in cement and other tanks to the extent of 20,000 gallons, a large supply of pure water being thereby rendered available for the dairy.

The fences throughout are in good order, and kept free from weeds, Mr. Warden having practically renewed them on his entry eight years ago. The external are of three-rail and the divisional of two-rail; barbed wire is only used across the water-courses. The paddocks, twenty in number, vary in size from 3 to 50 acres, the grass ones being browsed in rotation by the dairy cattle. There is a line of well-kept metalled road $\frac{3}{4}$ mile in length, extending from the homestead to the public road, and all its gates are of an excellent pattern, whilst throughout the paddocks there are slip-rails.

The homestead occupies a site nearly central to the farm, and the buildings are placed in a large rectangular paddock, with the residence and garden at one short end. The farm buildings extend along one long side, and away from them is placed the coach-house and stable, with a good cottage for the dairyman, and another, at a little distance, for a farm hand. There is also another farm cottage on the estate. The residence is a new, compact, and substantial building of stone, containing four rooms, with detached kitchen and other rooms, of brick. In front of it extends a large flower and vegetable garden, kept in excellent order, and most productive. The farm buildings consist of four groups, viz., the dairy, milking yards, piggeries, and barn, each possessing points of interest, and all very substantially built. The milking bails are six in number, under a good shingle roof, the upper part being used as a granary. The floor of the bails is paved with tar concrete,

and at the head of each is a door, through which the cow, when milked, passes into a yard, and is immediately followed by the next one awaiting milking. This simple addition does away with the confusion between incoming and out-going cattle that otherwise prevails, and should be generally introduced. The yards are paved with stone, and kept particularly clean, all manure being saved for the ploughed land. The dairy is a spacious one, originally constructed for the old hand system of butter-making, but eight years ago Messrs. Waugh and Josephson were entrusted with putting in a Laval separator and steam machinery which have worked from the first without any hitch whatever, and have given the utmost satisfaction. Mr. Warden is particular as to neatness, and the machinery is kept scrupulously clean, small repairs being attended to at once by himself. The engine—a four horse-power "Soho," by Tangye—drives also the food-preparing machinery, consisting of a corn-sheller, corn-cracker, chaff-cutter, circular-saw bench for cutting firewood, and a pump, elevating water to a tank, commanding the residence to which it is laid on, as well as to the garden and fowl-yard. The piggery is kept exceptionally clean, the floors being of cement, which possesses the disadvantage of being cold to lie on. The building it of weatherboard, with iron roof, neatly finished in every respect, having a central passage giving access to four styes on either side, each with a yard 6 feet by 8 feet, and a cast-iron feeding trough, cemented in. The concrete floors drain to the paddock, where there should be a tank to receive the liquid, which now soaks away to waste. The original piggery of slabs and battened floor is used as a calf-pen, and under it pigs in a large yard take shelter. There is a good-sized pig paddock adjoining, and a large copper is provided for cooking pig food. The barn, 60 feet by 25 feet, is of weatherboard, on stone foundation, with iron roof, and leans-to, affording thirteen roofed-in pens, to accommodate as many cattle in the winter. There is also a separate tool-house and smithy, a long range of poultry houses and yards, as well as an implement shed. The expenditure for residence and buildings could not be less than £1,200 in equal amounts, and was incurred on entry eight years ago. The homestead, for design, substantial nature, and attention to detail, may be regarded as a model one.

The implements comprise—3 one-furrow ploughs, disc harrow, 3 wood harrows, 2 wood rollers, Howard's hay-rake, "Albion" mower, "Planet, junr." hand garden cultivator (complete), 2 carts, and 2 drays, in value about £160. The dairy plant consists of Lawrence cooler, Laval's 90-gallon separator, 100-lb. Kiama churn, butter-worker by Cockerill, of Gerringong, "Avery" platform scales, can steaming plant, and a four horse-power "Soho" engine and vertical boiler by Tangye, "Hunter River" corn-sheller, corn-cracker by Richmond and Chandler, Bentall's chaff-cutter, and saw-bench, representing an outlay of close on £280, making a total investment of £440 for the machinery and implements enumerated.

The cropping of the farm was as follows:—Maize with pumpkins, 7½ acres; pumpkins, 1½ acres; planter's friend, 7 acres; oaten hay, 7 acres; experimental plots of Cape barley, ½ acre; wheat, ½ acre; rye, ½ acre; lucerne, ¼ acre; in all 24¾ acres under cultivation. The pasture land was 268 acres, and homestead 4¼ acres, in all 297 acres. The food requirements of the dairy cattle necessitate about 25 acres being cultivated, and each year a fresh portion of pasture is broken up, and the previous 25 acres laid down with rye grass and clover. The winter feed of the herd is green barley and oats sown in February, in spring they graze wholly on the pastures; and in summer have in addition green maize and kaffir corn, whilst in autumn planter's friend and sorghum is relied on. The pasture lea is ploughed up

with bullocks, and, if the ground is soft, by horses; the disc harrow is found most useful in cutting across the furrow slices, and maize is sown either broadcast for green fodder, or in a furrow for corn, in which case horse and hand hoeing is carefully attended to; husking takes place in the barn, and the stalks are burnt or rotted for manure. The yield on an average may be taken at 55 bushels per acre.

The mainstay of the farm is pasture, and to the very top of the ridge, some 300 feet in elevation, rye grass and clover grow luxuriantly. Every care is taken to keep the pastures entirely free from tussocks of coarse grass, which are hoed out and burnt. The paddocks are numerous and small in area, so that the cattle are shifted every day or so. The creek waters most of them, but in some dams have been made.

Fodder is requisite for carrying a large dairy herd over the summer, wherefore oaten hay is made, and about 14 acres of pasture are mown for rye-grass hay, some of which is thrashed for grass seed, and 2 bushels per acre are sown with oats on the renovated pasture.

About 2 acres have been laid down under experimental crops—wheat, ½ acre; rye, ½ acre; Cape barley, ½ acre; and lucerne ¼ acre. To the Steinweld and Leak's rustproof wheats, blood manure has been applied with marked effect. It is not to be expected that wheats can escape entirely rust, but early sowing and a good start with manure may force the plant along so that it cut a luxuriant crop for green feeding. The Cape barley is handy for poultry feeding, and for the pigs. Mammoth rye was a most vigorous crop, and lucerne had taken so firm a hold as will lead to its more extended growth. The pumpkins and a small quantity of Swede turnips come in for general use.

Manure is not generally made a feature on a dairy farm, but Mr. Warden keeps the stables, milking yards and piggeries particularly clean, and the gathered manure is heaped for use in the vegetable garden and ploughed areas. If the drainage from the piggeries was collected and used to moisten the heap more perfect farm-yard dung would be made.

The live stock number 19 horses, 189 cattle, 50 sheep, 67 swine, and 150 head of poultry, which may be valued at £1,327. The horses were a good type, there being 3 plough-horses, 6 saddle-horses, and 10 breeding-mares, but the South Coast district is not a satisfactory market, save for a good driving-horse. Working bullocks are needed on this heavy land. The milking-herd is of the representative Illawarra type, Durham predominating, with crosses of Ayrshire and Jersey, the whole forming an excellent collection of milkers. There were 75 cows in milk, 30 dry, 20 springers, 50 yearlings and calves, 2 bulls, in all 177, and 12 working-bullocks; total, 189. The pasture is good, but the cows were somewhat thin, showing that all they can eat is needed for the milk supply, consequently a feeding-ration would be beneficial. This drain on the system is observable in most dairy districts, save where the pasture is exceptionally rich, and there condition and milk yield go together. The average age of the cows was moderate, but at Milton it would not be economical to cull a milker until she ceased to milk at a profit, seeing what little value cattle fetch to-day, stores selling at 30s., and fats at £6. The bulls in use were pure Durham of high dairy quality, and one of a first cross between the Durham and Ayrshire, also of the best milking strain. The natural goodness of the herbage on the ridge kept the springers and dry cows in prime condition. The herd, as a whole, is worthy of high commendation.

A few crossbred sheep were kept, and looked remarkably well, coming from the Braidwood district, and yielding excellent mutton for home use,

and a cross between the Lincoln and Southdown lends itself to this purpose. The character of the swine was exceedingly good, the boar and breeding sows being of New Zealand strain, coming from Rowe, of Christchurch. The stock comprised 1 boar, 6 sows, 15 fat pigs ready for market, and 45 young pigs, in all 67. There were 150 head of mixed poultry carefully attended to, in good houses and yards. A 100-egg incubator has given fair satisfaction.

The kitchen and fruit garden with several trees were carefully tended, and grew a great variety of vegetables for household use.

A farm-labour book was kept, together with a full record of dairy-herd data, butter returns, as well as entries of purchases and sales. The labour bill may be taken as £271 per annum, the dairyman being paid 25s. per week and a house; his wife acts as butter-maker and milker, getting 12s. per week, and the son and daughter 3s. each. The plough-hands received 25s. and 24s. with house, the plough-boy 14s., and a State boy, boarded out by the Government, also takes the milking, so that there are six milkers to deal with the 75 milkers.

The subsidiary aids are pig-breeding, bacon-curing, cheese-making, poultry-raising, and the sale of eggs. Some pigs are killed yearly for home use and the bacon cured, the surplus being sold. Butter is the main product of the farm. It was carefully made, and of a very high quality, invariably fetching a good price in Sydney.

The points of interest may be taken as a well-designed homestead, residence, and farm buildings throughout, the making of cheese, engine power applied to many purposes, an incubator, cooked pigs' food, and methodical renovation of the pastures, together with a superior milking-herd.

The general management, with a view to profit, hinges upon dairying, the climate and pastures being well suited, whilst the restricted area of the coastal district renders it the only possible line of farming. In years gone by Ulladulla butter, made by the hand method, had an excellent name, and steam communication gave cheap transit to market. The separator, moreover, was taken up by individual farmers at once on its introduction, and to-day there is no co-operative butter factory at Milton, because the leading farmers all have separators. Competition in the butter trade, however, increases. The districts in connection with the metropolis by rail are hurrying cream forward to be churned in the city, and they can also forestall the sale-days of sea-borne butter, wherefore it behoves that the utmost pains be taken that the latter be first-class. It must necessarily be a great disadvantage to the trade that dozens of different makes and brands come forward from each seaport, whereas one uniform packing, such as the factory for the district would produce, would command the market; and the time may come when existing separator plants will become creameries and forward each day's cream to the butter factory at the port. Mr. Warden is one of the large farmers of the Ulladulla district, and gets full price for his product; but he complains of the frequent samplings each tub undergoes when on sale at the agents, this being the outcome of so very many small shipments instead of one brand of uniform quality being sent forward. The skim-milk is utilised in rearing calves and fattening a really good type of pig. Some very promising cheese has been made from directions given in the *Agricultural Gazette*. The dairy herd represents eight years' skill and forethought. The rotation of grazing protects the pastures from being eaten bare, and the system of cropping supplements them with hay and green food. They are also methodically renewed every year. Poultry adds £100 per annum to the turnover, and the other returns amount to £1,000,

whilst the money invested in improvements, plant, and live stock cannot be less than £3,000. It is interesting to note that the average of butter per cow per annum was 212 lb., selling at £10 12s. The farm stands forth as excellently managed and representative of the highest type of tenure, giving entire freedom of management with lifelong possession, and a sense of security in the investment of profits.

W. H. Wilford, Loch Leven, Milton.

South Coast District.—Place, No. 2; points, 90·31 per cent.; arable, 34 acres; pasture, 127½ acres; swamp, 38 acres; homestead, 3 acres; orchard, ½ acre; total, 203 acres.

(8 November, 1893.)

Loch Leven is 203 acres in extent, and occupies a sheltered position from the north-east and westerly winds. It is distant 2 miles from Milton, and 2 miles from the port of Ulladulla. A ridge of low hills separates it from the ocean, and a saltwater creek, navigable to small craft, bounds the property on the south-western side. From the dwelling-house a very pretty view is got of its waters, which also afford much pleasure in boating, fishing, and shooting. Thirty years ago the land, when in a partially-cleared and unimproved condition, was so uninviting that the highest bid at auction was £900. It was withdrawn then, and since sold and let to a tenant for a short period before it attracted Mr. Wilford's attention. Happening to be on a visit, he saw the capabilities of the land, and secured 137 acres in 1870 for £1,300, and since then 66 acres have been added at a cost of £800 so that 203 acres cost £2,100, *e.g.*, a trifle more than £10 per acre.

Mr. Wilford comes of a family of Yorkshire farmers, and, although not at first when in the Colony engaging in agriculture, commenced the hereditary profession by renting a farm at Kiama, next at Jervis Bay, and finally at Milton. The low-lying lands by the saltwater creek were a swamp and lagoon, so that Mr. Wilford's first procedure was to construct flood-gates, and shut off the tide, whereby the lagoon was made sweet water. Contour ditches were run at the foot of the slopes to cut off the hill soakage, and amidst much dirt, and with great labour, surface-drains were made through the marsh, leaving the present lagoon of 3 acres, which is frequented by wild fowl at times in great numbers. The black mud of its bed has, however, been utilised for dressing pastures with the greatest effect, whilst heaps of shells found elsewhere on the property have been largely availed of as an additional fertiliser. The farm in 1870 was covered with tussocks a yard high of coarse grass, whilst weeds overran the land. Mr. Wilford, unaided, burnt these off, felled the dead rung-timber which cumbered the ground like a forest, burnt it off, carefully spread the ashes, sowed rye-grass, and laid the foundation of the splendid pasture of to-day. The farm is now wholly cleared and fenced off into small paddocks watered by ever-running streams in every undulation. The land lies in horse-shoe form around, and gently sloping down to the lagoon, and two-thirds of the estate can be viewed from the drawing-room window. The conditions of the district render dairying the chief and most profitable pursuit, and butter from Loch Leven dairy has had the best demand in Sydney. Such excellent pasture is worthy of high-class stock, and Mr. Wilford's herd is unsurpassed in the Colony.

The geological features are that a volcanic rock is overlaid by a deep, rich brown soil of great fertility. The iron of the component minerals of the rock accounts for the rich colour, and it would be interesting to learn

by analysis whether the felspar is of the potash group. Many boulders found throughout the soil weather rapidly, and renew its fertility. Here and there some clay is met, and in one part sandstone outcrops, yielding a poor soil.

Drainage on the slopes is not requisite, and the reclamation of the marsh deserves the highest credit. Streams that never fail water every paddock, whilst underground tanks, holding 22,000 gallons of rain-water, provide an ample supply for the homestead and dairy.

The fences throughout are three-rail with twenty-three gates on the property, all made by Mr. Wilford save one, and there are some slip-rails. The fences were in good order. There are twenty-four paddocks varying from 3 to 20 acres in extent, which enables the pasture to be grazied in rotation. A main public road bisects the property, affording ready access to most of the fields.

The residence consists of a six-room stone house, occupying a commanding site, with a beautifully kept garden in front, showing what the soil can grow. There are offices and other rooms in addition, and adjacent is the large dairy building, with butter-making conducted on the old-fashioned "set" system, the churn being worked by an American one-horse tread gear, once not uncommon in the South Coast district, but now rather rare. On the other side of the quadrangle are the coach-house and stables, an enclosed shed. and range of piggeries. Hand-tools are kept in their proper places, and there is a portable forge with various tools for doing repairs, shoeing, and general carpentry at home, Mr. Wilford being more than an amateur. A hay-shed is erected in a paddock containing an emergency supply of fodder. The dairy is of stone, and the other buildings of slab and weatherboard, all being serviceable for their purposes. The piggeries have runs leading to the slaughter-yard, as well as a paddock with a small area of the densely overgrown original brush, showing what difficulties encountered the pioneer in clearing the land. Poultry form somewhat of a feature, and are provided with several yards and houses, and the bees are kept in the garden. The milking bails and yards are of the usual type, and two have recently been commenced in response to the invitation of an officer of the Department of Agriculture for a model design, on a plan introduced by Mr. Wilford when at Jervis Bay. By a cord, the milker, without moving an inch, first releases a door at the head which flies open, and then the bail falls back, so that the cow is free to walk out and a successor immediately comes to the bail without confusion. Mr. Wilford also possesses drawings of a milking-machine, designed by his brother, the late Mr. Charles Wilford, some twenty years ago, which show all the essential features of the most recent plans to milk by means of a vacuum.

The following is the list of implements:—One one-furrow iron and two one-furrow wood beam ploughs, two wooden harrows, "Albion" mower, "Howard's" hayrake, "The Reversible" scuffle, corn-sheller, corn-cracker by Richmond and Chandler, American horse-tread, two spring-carts, dray, slide, and buggy, "Adkins" 100-egg incubator, tools and forge, platform scales, two large churns and appliances for a hand-dairy.

The farm is cultivated as follows:—Maize, 14 acres; sorghum and Planters' Friend, 20 acres; in all 34 acres—arable, 127½ acres; rye-grass pasture, 3½ acres; homestead, orchard and paddocks, and swamp, 38 acres; total, 203 acres. Maize sown broadcast for green food or in the furrow is well hoed, husked in the barn, and the stalks are rotted in heaps for application to poor land. Some very large yields of maize have been secured, and in the competition for 1892 for "the best prize acre of maize" Mr. Wilford ranked

only four points behind the winner, who grew over 100 bushels to the acre. "Hogan's" corn is sown, and none is sold, all being required for the live stock and pigs. Sorghum sown broadcast is relied on for green fodder during late summer, the cows being timed to be in full milk for the more profitable winter season, so that during summer the milkers are comparatively few. Planters' Friend, if sown broadcast, is found to be the cheapest means of stifling weeds, and has been so used for many years past to cleanse the pasture paddocks. They are also renovated whenever signs of getting poor are observed by the application of lagoon-mud and shells. During the past three years 38 acres of lea have been ploughed up for maize and sorghum, to be resown with rye grass. When Planters' Friend is sown to stifle weeds, the lea is ploughed in October, and sown at the rate of 30 lb. of seed per acre broadcast. In May it is cut, the heads being housed to dry, and the stalks taken on a slide to the cattle. The threshing is by flail, and last year 3 tons of seed were got from 5 acres, being at the rate of 22 bushels of 60 lb. to the acre. The selling price is 3d. per lb., or a return of £18 per acre. Rye-grass is also harvested for seed, and this season two paddocks, aggregating 13 acres, have been laid up, to be cut about the middle of November, when the heads are full ripe. A light hand-rake gathers the heads into heaps, and the cut grass is lifted on to one sheet and covered by another. It is then drawn on a slide to the threshing-sheet, which is set in a paddock, and threshed by the flail. After a rough cleaning the seed is dried in a loft, and put through a winnower, the foreign seeds easily shifting out. Sales are readily effected at from 10s. to 12s. per bushel of 20 lb., one acre yielding 30 bushels, or £15 worth of seed. A small cultivation plot on the reclaimed flat gave evidence of the suitability of the soil for the growth of potatoes, sugar beet, and mangold, which were for home use. Pumpkins are planted throughout the corn, and when sown by themselves pig-manure is buried beneath the seeds, which make, in consequence, a vigorous start. A few pumpkins are sold. Two acres of lucerne, sown as an experiment during the last week in August, have made a wonderful growth. A barn 20 feet by 18 feet is kept stored with oaten and rye-grass hay as a standby, and although the seasons seldom cause anxiety where such grand pasture grows, Mr. Wilford prefers to run no risks.

The system of manuring with lagoon-mud and sea-shells has been noticed. All yard-droppings are gathered and rotted in a heap for general application. In order to prevent weed seeds being introduced through the sheep-dung manure into the garden, it is used as a liquid. Maize-stalks are not burnt. Last year, as an experiment, small plots were manured with blood and bones.

Fodder is conserved as hay, and pastures are systematically laid down. It would be difficult to meet with cleaner or more luxuriant rye-grass pastures. The land, after maize, sorghum, or planter, is sown broadcast with home-saved rye-grass seed, mixed with the clover that has been reaped with it, at the rate of 2 bushels per acre, and in a few weeks it becomes established pasture. There is a coarse water-grass, with sharp, serrated edges, which frequently serves to cut off the front teeth of grazing animals, known as "Cutty" or "Merramarang" grass, after a station so named. Mr. Wilford has observed that the ill effects only take place on animals with a change of mouth. The leaves, getting between the teeth, act as a saw, and soon cause the loss of several. He eradicates it successfully by constant mowings and ploughings in a dry season. The live stock number 8 horses, 164 cattle, 40 sheep, 52 swine, and 380 head of poultry. The horses number 8, and include 1 stallion, 2 plough-horses, and 5 saddle and buggy horses, 2 of the light

being breeding-mares. "Royalty" is a coaching stallion that has a reputation in the neighbourhood, and adds to the farm turn-over, having served thirty mares at £3 3s. this season. He is out of a Cleveland mare, who was by "Duke of Cleveland," an imported horse of that breed. His sire is "His Royal Highness," an imported Yorkshire trotter. In "Royalty" the Cleveland characteristics predominate, in colour a striking bay, with black points, 16½ hands high, with clean bones, powerful limbs, and great strength of back. Carriage-horses of this type will be equally useful for all farm purposes, and if the young stock possess style they will be certain to command good prices in the Sydney market. The cattle number 4 stud bulls, 31 stud cows; in all, 35 stud cattle; also, 49 milkers and 80 head of young stock; total, 164. Three of the stud bulls are Durhams and 1 Ayrshire; 25 of the cows Durhams and 6 Ayrshire. Mr. Wilford is justly proud of his dairy herd, the outcome of thirty-five years' experience and selection. It was started with Durhams of Low's Murrumbidgee strain, famous in 1858 for large frames and deep milking, and has been increased by using Durhams, which were the pick of the Kiama district. When at Kiama, the best Durham bulls that could be procured were used. In 1879 "Tacitus" dominated his herd, a famous bull by "Victoria's Theodore," whose sire was of Dr. Jenkins' Nepean Towers herd, and with a pedigree on the female side back to the original E. M. Cox's cattle of Mulgoa. Home-bred bulls of the "Tacitus" strain were used up to 1887, when Mr. Wilford determined to introduce for the sake of vigour an Ayrshire touch in the shape of "Scotchman," a pure-bred bull two generations removed from "Tahuna," the Ayrshire champion of New Zealand in 1879. "Scotchman" having impressed his features on the herd, recognised by leopard-like markings and a great milking record, has now given place to a Durham bull, "Duke," aged 9 years, from a pure Durham coast sire and dam, the parentage on the mother's side being pure "Major." "Duke's" father was of "Conqueror" strain, which is noted as possessing especial milking characteristics of the long-horn Durham or Bates family. In the herd to-day the stud cattle consist of the "Tacitus" cows and young stock that are half Ayrshire by "Scotchman," only first crosses having been kept. Heifers have been seldom sold, because the stocking of a son's herd has absorbed a large draft. The average price obtained for twenty-four "Tacitus" bulls during about seven years has been £19, and the "Scotchman" bulls realise £10 apiece. So well-known a herd has swept numerous prizes from local and metropolitan shows, the record of first prizes won by "Tacitus" cows since 1885 being fifty-four. The average number of cows in milk is thirty-seven, and the books show a return of nearly £14 16s. for butter per cow per annum. The cattle throughout are of a particularly level type, in first-class condition, Durham reds predominating, the Ayrshire cross with leopard markings being noticed at once, and the points of both are typical of milkers, with prominent veins and large udders. The Durhams are all that such famous cattle should be, and the Ayrshires are equally as good. With skill in the dairy and such good cattle it is no wonder that Loch Leven hand-made butter gets top factory price.

Swine are so closely associated with a dairy in the economy of using skim-milk that Mr. Wilford commenced in 1892 to found a pure strain of large Yorkshire pigs, obtaining from Rowe, of Christchurch, New Zealand, "Windsor Prince," a boar 21 months old, and "Countess of Glasgow," a sow aged 3 years. He now has four other sows and a young boar of another family, making seven in all. The Yorkshire have taken many prizes, and young boars sell at £4 4s. and sows at £2 2s. apiece. These pigs grow to a great size rapidly, a boar six months old, and sold at the time of my visit,

weighing 200 lb., and a half-bred sow 183 lb. at five months old. There are 4 Poland-Berkshire breeding-sows and 41 stores fattening, in all 52 pigs. A few cross-bred sheep are reared on the farm, being got by Southdown rams out of Lincoln ewes, and serve for home consumption. The flock numbers 40 sheep. Poultry are well cared for, numerous pure varieties being kept, including Houdan, Game, Orpingtons, Plymouth Rocks, Leghorns, also 80 ducks, including several wild ducks, hatched from eggs found near the lagoon, which large numbers frequent. An "Adkins" 100-egg incubator has given 80 per cent. results. Bees in gin-cases have dwindled from 50 to 7 hives, because of the depredations of the moth, but Langstroth frames are now about to be used. The vegetable garden is a picture of luxuriant culture, showing splendid results from choice seed. There is a small orchard and fruit garden where citrus and stone fruits,guavas, vines, and persimmons do well. It was found that oranges did not succeed, until by cementing a block of soil 4 feet in diameter, and then planting on it, so as to disperse the roots in a wide circle rather than let them go straight down. The fruit and vegetables are for home consumption.

Bookkeeping comprises a day and cash book, and data relating to herd, stud, and dairy products. The labour of the farm is done by the co-operation of three sons, and two "State" boys, who very readily take to farm-work and milking, and will in time become useful members of society, the State having taken charge of them as utterly poor, but not in any way tainted with crime.

The subsidiary aids are co-operative family labour, home-killed mutton and beef, about a beast a fortnight being used, and the surplus meat sold to neighbours, home-cured bacon, sales of horses, stud cattle, pure-bred swine, and poultry; also butter, eggs, and table-birds, as well as pasture, sorghum, imphie, and planter seeds; home repairs and carpentry.

The points of interest are the planting of a long line of thorn hedge as a wind-shelter, and numerous ornamental trees near the residence, including elms, poplars, pepper, and pines; the reclamation of a marsh; the planting and renovation of rye-grass pasture; the eradication of tussocks by hoeing, of weeds by Planters' Friend, and of "cutty" grass by mowing; a dairy herd of the highest character, and butter of prime quality; timing the cows to calve during winter; keeping a reserve of hay.

The general management, with a view to profit, may be summed up as good pasture, good stock, and good butter. The excellence of the land, its fertility, and the means taken to sustain it, is evidenced by the beautiful growth of rye-grass and clover. Fewer cattle are kept than the land will support, but Mr. Wilford likes to have a reserve of food. The fences are good, paddocks small, water never-failing, and roads convenient. The cattle are constantly changed from pasture to pasture, and that which looks either dirty or poor is renewed or manured. The cultivated area provides green food during the seasons when needed, and seeds are saved for sale at a profit. The dairy herd excels as milkers, pure strains are kept, and an Aryshire cross, proved years ago, to add vigour, has been repeated. The dairy work is well done, and top price for butter proves that the old system can hold its own against the factory. The original outlay of £2,100 may be regarded as having been supplemented by quite that amount of improvements, and the capital invested in plant and live stock cannot be less than £1,400, whilst the returns for 1892 amounted to £1,263. The annual value in butter, from each cow, came to £14 16s. What the auction value of this farm might be cannot be stated; possibly £40 per acre would be too low a figure.

J. H. Sommerlad, Spring Valley, near Tenterfield.

North Tableland District.—Place, No. 6; 83·26 per cent.; arable, 91 acres; pasture, 6 acres; rung, 450 acres; homestead, 1 acre; orchard, 4 acres; total, 552 acres.

(24 November, 1893.)

Spring Valley farm affords an example of a mixed farm in which dairying and a large orchard form leading features. Mr. Sommerlad was brought up to nursery gardening near Frankfort, in Germany. He arrived in the Colony in 1855, and went to a situation on a station in the neighbourhood of Tenterfield. It was incumbent on him to repay his passage-money, and in two years' time this was accomplished, with a surplus saved as well, although the wages were low, but many extras were earned by general handiness. In time he set up in Tenterfield as a fruit and vegetable grower, there being an excellent market by reason of the mining in the district. The 10 acres of the first occupation yielded sufficient money to enable him to purchase, in 1877, the 404 acres of the Spring Valley farm. There was, at that time, only £100 worth of improvements on the property, but an orchard was planted, and as years passed more and more land was fenced and cleared, drains were cut, boulders removed, and hollows filled up, until now 100 acres are under cultivation. The profits since 1877 have been invested in the farm, and in bringing up a large family, of whom ten are now living, two sons on the verge of manhood, and associated with the father in the work of the farm, having passed away. Family co-operative labour has been the secret of success. Some additional areas have of late years been acquired, 97 acres being taken up as a selection, and 14 acres purchased; whilst 37 acres have been selected since the farm was entered for competition.

Spring Valley is distant 4 miles from Tenterfield, and is about 2,800 feet above sea-level. Several public roads lead to or pass through the property. The lay of the land is a gentle slope towards Washbrook Creek, which is never dry. The property extends up to and over some low ridges of granite hills, precipitous and boulder-strewn, yet upon which nutritious grass grows, but where cultivation is entirely out of the question. The principal timber is peppermint, mostly ring-barked, and what is left only sparsely covers the ridges. High mountain ranges are distant some miles on every side. The chief winds are west and east, the latter generally bringing rain, which averages 34 inches per annum. The market for produce is somewhat limited, seeing that Queensland and barren country hem in Tenterfield, whilst the distance to the "Elbow" on the Clarence, to which the river is navigable, is 80 miles by a rough road, effectually cutting off the coast and sea shipment. When Deepwater and Fairfield were active mining centres, Tenterfield did a flourishing trade, and in fact the town has been built up out of mining.

The high elevation of the tableland renders the climate very bleak in winter, live stock suffering, and dairy cattle have to be hand-fed. For fruit-culture the locality is well suited. The country rock is granite, and the soil is rotten granite, more or less deep, and in some places a cold clay underlies. Where this occurs in the undulations a black soil of marsh origin is found.

The gentle slopes of the farm afford fair soil for cultivation, and a great deal of time has been spent in removing boulders by blasting, and either piling the debris in heaps or in filling up with it inequalities, and carting soil over so as to make a surface for cultivation. A large amount of

draining and trenching has been done preparatory to planting the orchard, as well as in the reclamation of wet ground. One open cut, 4 feet x 2 feet, extends 400 yards, furrow ditches have been made, and a mile of underground drains of stone and wood have rendered the orchard-ground good soil. The new orchard has, moreover, been trenched $2\frac{1}{2}$ feet deep, and four years ago 300 trees were planted 25 feet x 25 feet apart.

There is no need for the conservation of water by reason of the regularity of the rainfall, small iron tanks being sufficient for the household; the creek is never dry, and a small dam suffices for the homestead paddock.

The enclosing fences are of one-rail, with two or three wires, and some of two-rail; the original fence is being renewed, otherwise they were in good order. There are ten gates to the six cultivation paddocks, and slip-rails to the pastures.

The homestead lies on a gentle slope overlooking the greater part of the farm, and consists of three adjoining slab cottages, facing the extensive flower-garden and orchards; and at the back is the quadrangle of the farmstead. Mr. Sommerlad removed the original cottage of four rooms from an unsuitable site to alongside the second cottage of five rooms, containing the kitchen, and with a lean-to, where are placed the fruit-evaporator and blacksmith's forge. A smaller cottage, in its own garden, is occupied by the daughters. The flowers and orchard give to the whole a pretty effect, and thorn-hedges have been planted for shelter. The farm steading occupies the other sides of the farmyard, and consists of distinct buildings of slabs with iron or shingle roofs. In it is comprised a barn, seven-stall stable and harness-room, three milking-bails, an open cartshed, a smaller barn, a meat and bacon curing shed, the dairy, an apple-room, and tool-house. The poultry-yards and piggeries are near by. The latter present a comfortable appearance, and consist of a low shed, with board floors, divided into three styes, two of the open yards being paved and thickly bedded with straw, which sops up the slush of the usual stye. The poultry-yards were clean, and the house subdivided. The somewhat unusual feature of a place for everything was noticeable—pegs for the harness as well as the hand-tools. The milking-yard was straw-littered, and therefore clean, no straw being sold, but all kept for manure. If the farmyard manure was made in a covered pit, with a cistern to catch the drainage, a better method would be instituted.

The implements comprise 3 one-furrow ploughs, a two-furrow, by Hornsby, with the original long mould-boards shortened, and is especially liked for use where boulders lie on the surface; a two-furrow orchard plough, made by Hill, of Tenterfield, after an American model, is highly prized for cleaning weeds in both orchard and field; an expanding iron horse-hoe, of Toowoomba make; a double mould-board plough, with potato-raising body, wood roller, iron harrows, Wood's mower, and Deering's string binder, which has given great satisfaction; horse-rake, horse-gear, Bentall's chaff-cutter, corn-sheller, and a 50-cow dairy plant for the "set" system, but not now used since the milk goes to the factory. Also honey-extractor, small cheese-plant, Avery platform scales, two drays, spring-cart, and buggy. Light repairs are done at home.

The farm is laid out as follows:—Arable land, 97 acres; natural pasture, 450 acres; homestead, 1 acre; orchard, 4 acres; total, 552 acres. On the cultivated area there are grown 45 acres of wheat, 24 acres of oats, 16 acres of maize, 6 acres of potatoes, and 6 acres of artificial pasture. There is no fixed rotation of crops followed; but after two years rye-grass a crop is taken of potatoes or wheat, followed by oats or maize. Frequently potatoes follow

wheat. The wheat, maize, and oats are sold, and the straw is stacked for litter. The cereal hay is sold as chaff, or used at home, and potatoes are sold. Cavings after thrashing are burnt, to destroy sorrel seeds, insect and fungoid disease. Wheat is taken after a two years' rye-grass lea, or maize, or potatoes. Ploughing starts in April; 1½ bushels of seed is broadcasted per acre, the varieties being "Sommerlad's Champion," raised on the farm, in type similar to "Talavera," and looked upon as the most satisfactory; "Californian," "Lambrigg," "Egyptian Bearded," and "Allora (Queensland) spring wheat." The average yield, over a term of years, may be taken at 16 bushels per acre; but a 14-acre field of "Champion" had been manured with 200 loads of farmyard dung, and the growing crop looked like 26 bushels to the acre, showing how desirable it is to manure. The crop is cut by the string-binder, stacked in the farmyard, or stored in the barn, and thrashed by steam at 1s. per bag. The market is local, at about 3s. per bushel. Complaint is made that oats are not separated by the thrashing machine, wherefore their prevalence in the growing corn was to be accounted for; but this breadth will be cut for hay in consequence. The sorrel is stated to have been introduced into the district with New Zealand oats used by the contractors for the railway, and the cavings are burnt to destroy its seed. Preparation is made for potatoes, when they follow maize, by two ploughings, and it is contemplated to get a disc harrow, so as to save the second ploughing. As much farmyard dung is applied as can be spared. Planting takes place from September to November, so as to get crops from December to May. The varieties in favour are "Early Rose," "Brownell's Beauty," and "American Flourball." Weeds are kept down, and a plough with potato-body is used to dig up the crop. The yield is from 4 to 6 tons per acre. This year (1893) £5 per ton has been realised, but the previous year £2 only. For planting, small tubers culled from the main crop are preferred. Oats may be cut for grain or hay, a field of "White Scotch" looking like 36 bushels per acre. Fodder crops of wheaten or oaten hay are taken after maize, ploughing for the wheat from April to July, and for the oats from August to September, sowing broadcast, wheat, 1½ bushels, oats 2 bushels per acre, and harvesting the crop by Wood's mower. The stack is made in the yard, and is thatched with rushes grown on the swamp. The yield is from 1½ to 2 tons of hay per acre, the market is local for chaff, cut by a travelling steam-plant, and sold at from £3 to £3 10s. per ton. Much is used at home for winter feed. Maize follows wheat, ploughing starting in October; the seed, "Early American," is dropped by hand in furrows, 3 feet apart; hoeing is kept going, the cobs are husked in the barn, and the yield is from 30 to 40 bushels per acre. The market is local, at about 3s. 3d. per bushel. The stalks are ploughed in, or, if burnt, the ashes, like those of the cavings, are applied to the orchard. Green manuring and catch crops are not resorted to. Some rye is sown for its long and strong straw, which is used to bind the fruit trees. In the orchard there are grown, besides potatoes, small breadths of various crops, such as ½ acre field peas, ½ acre English barley, ½ acre Cape barley, and ½ acre rye, the seed from the latter being sold to neighbours at 6s. per bushel, for the growth of green fodder. The straw sells at 6s. per cwt.

Manure is made in the farmyard, and ashes are used in the orchard.

Land is laid down to grass for a rest, particularly the wheat-land, and after two years is completely renovated. Although rye-grass is only sown, an abundance of white clover springs up naturally, and materially assists in restoring the fertility. Five pounds of rye-grass seed, grown on the farm, is used per acre, being sown with some black oats; hay is made the first year,

and afterwards the growth is depastured. Buffalo-grass is good for certain moist spots ; but Mr. Sommerlad regards it as unwise to add it to pasture that has to be ploughed again. As for couch-grass, it dies off on the approach of winter, and is not liked.

The live stock comprise 30 horses, 120 cattle, 6 swine, and 100 head of poultry. Owing to a continuance of a dull market the horses have accumulated, the stock numbering 17 plough, 11 buggy and saddle, and 2 stallions, one of the latter not being of a high type. There are in all 9 breeding-mares. The milking-cattle amount to 31, springers, dry, steers, and youngsters, 89—in all, 130. The prices for cattle are exceedingly low—50s. for a dry cow, and £3 for fats; and the 31 milkers, through having the calves with them all day, only yield 21 gallons daily. The recent opening of a butter factory, and of which Mr. Sommerlad is a managing director, has done away with the dairy, and it is contemplated to build up a dairy herd; but there is a dearth of good milking-stock in the district. The rigour of winter has predisposed cattle to be poor, but Mr. Sommerlad fully intends to reduce the excessive number of unremunerative horses and cattle in favour of a true dairy herd. No sheep are kept, and there are 6 swine, a young boar and sow of excellent Berkshire type; also, 4 young pigs fattening on skim-milk, and on reaching 140 lb. weight will be killed for home-curing. The poultry number 100 head, various pure strains being represented, including Brahma, Spanish, Dorking, Leghorn, Plymouth Rocks, Hamburg fowls, Muscovy and common ducks, and guinea-fowl. A Plymouth Rock hen has laid 131 eggs consecutively. The market is local, eggs fetching at from 6d. to 9d. per dozen, and table-birds 1s. 3d. to 1s. 6d. each.

The orchard is a leading feature of Mr. Sommerlad's farming, he being a trained nurseryman, and has sold much plant stock at good prices locally—indeed, a large proportion of the fruit-trees of the district appear to have passed through his hands. The first orchard was planted seventeen years ago, and the trees selected for the new apple orchard of four acres may be taken as affording a criterion of the varieties suitable. The stocks are home-grown, vigorous, clean in the bark, and free from blemish, appearing to be proof against blight. They stand 4 feet high before branching, so as to allow for ploughing, and the pruning is on the outside, the interior being purposely kept dense so as to shelter the fruit from sun and wind. The trees are allowed a good deal of natural growth without topping. The new apple orchard occupies a gentle slope, the soil being a deep rotten granite, trenched 2½ feet deep, and all boulders extracted, at no small cost. Where necessary there are underground drains, to a total length of 1¼ miles, since clay underlies in places. The trees are spaced 25 feet, and comprise 36 Winter Majetin apples, 24 Frampton, 36 Orange Pippin, 12 Scarlet Pearmain, 12 Beauty of Kent, 12 Lord Mason, 24 Red Caldwell, 12 New England Pippin, 24 Lord Wolseley, and 12 Yeates seedling, 12 Irish Peach, 24 Windsor Pearmain, 24 Five Crown Pippin, 12 Jupp's Surprise, 12 Nonpareil, and 12 trees of mixed sorts ; in all 300 trees. Lord Nelson is a great bearer, and good for table and cooking ; Brown Spice is an excellent baking apple, as is also Beaufort Norfolk ; Five Crown Pippin does very well ; Lord Wolseley is the finest winter apple, and Bismark nearly equally so. In the ten-year old pear orchard there were five trees each of Napoleon, William's Bon Chrêtien, and Evan's Egg. The growth was very satisfactory, but the Windsor pear, as elsewhere, has failed to bear, and therefore has been grafted with better sorts. Plums do very well, and comprise English Damson, Sommerlad's Damson Red German Quetcha, Early

Tippett, Black Prince, Black Diamond, Sweet Damson, Black Orleans, Magnum Bonum yellow, Early Japanese (peach) plum, Frankfort Peach, Blue-gage, Green-gage, Late Orleans, and Cole's Golden Drop.

Cherries do remarkably well, and some seedlings are of great promise. Amongst the varieties are, Bigarreau, Sommerlad's Seedling White, Florence Black,—a great and luscious bearer, and various seedlings. The splendid growth made by some first-year grafts is worthy of notice. There are some forty trees alternating of Spanish Walnuts and Chestnuts. Nursery stock sells at £5 per 100, 15s. per dozen, and 1s. 6d. each. The prices for fruit are: cherries, 10s. per quarter-case, grapes 6d. per lb., peaches 3d. to 1s. per dozen, and 6s. to 8s. per half-case.

Vegetables are grown to some extent, and much assistance is derived in marketing by the Tenterfield Union Store, which Mr. Sommerlad has taken an active part in organizing. Fruits, produce, and poultry are sold by auction. The market day is Saturday, and produce not sold then is kept on sale throughout the week at Saturday's prices.

Bee-keeping is pursued by the third son, who is rapidly getting a mastery of this interesting occupation before launching out on a large scale. There are six hives, Hoffman's self-spacing frames being used, and the frame material is got from Sydney; queens are reared. The extractor is "the Novice," and a good price is obtained locally in glass packages. Miss Sommerlad is proficient in the preservation of fruits, numerous prizes having been won in local competition. Bacon is cured, and has also gained many awards. The pigs are well cared for and cleanly fed. Dry-salting is continued for a week until all the blood is drawn out of the tissues, then strong brine is resorted to, and finally smoking with wood-chips, and a few green gum-leaves. An experiment was being conducted in packing the cured bacon in a cask, with lime sprinkled in layers. The local prices are 6d. for sides, 9d. for hams, and there is room for a much larger output, only 10 pigs per annum being cured.

Mrs. Sommerlad has prepared some true arrowroot, which grows well. There is also a built-in fruit evaporator about to be re-erected in a house by itself. In past seasons it has done good service, and is of so simple a description that any mason can set one.

Bookkeeping is represented by a record of sales and purchases. The labour is provided by the family, one son undertakes the cultivation, a second, the orchard, and a third, bees and bookkeeping. Mrs. and the Misses Summerlad attend to the dairy.

The subsidiary aids are co-operative family labour, sales of nursery stock, butter, bacon, eggs, poultry, honey, various seeds, and partial home repairs.

The points of interest may be enumerated as; clearing of boulders, drainage of a marsh and the orchard. Extended orchard culture, a good class of swine—the preservation of fruit by evaporation and in syrup.

The general management with a view to profit is good. The land represents an original outlay of £600, and the invested profits of sixteen years farming. The annual sales amount to close on £600; in the proportion of general produce, £280; dairy, &c., £160; orchard, £140.

The buildings are suitable, implements well selected, the bacon trade can be expanded, and the importance of a superior milking herd is recognised. The orchard has done well in the past, and the enlargement is based on a wise selection of suitable trees. Not long ago £3,000 was offered for the property and refused.

William O'Meara, Maryvale, Hickey's Creek, 28 miles from Kempsey, Macleay River.

North Coast District.—Place, No. 7; points, 79·77 per cent.; arable, 40 acres; rung, 990 acres; homestead, 2 acres; orchard 1 acre; total, 1,033 acres.

[12 December, 1893.]

Maryvale is a mixed farm in its full sense, in that, whilst 40 acres are cultivated, stock are grazed on nearly 1,000 acres of ridge country mostly rung, and affording a good natural herbage that would probably pay better with sheep than with cattle at the present low prices. Mr. O'Meara, who is a native of the Macleay, has a decided opinion as to the value of having a run in connection with arable land. His views are based upon experience derived from the havoc occasioned by recent floods, in that, whereas instead of harvesting 2,500 bushels of maize he only saved last March 300 bushels, realizing under £30. Had it not been for the cattle on the run returning £160, he would have had no income for the year. The turn over on this farm from all sources in a really good year, may be taken at about £720; so that mixed farming is not to be despised. The farm, moreover, shows how pre-eminently desirable it is to associate a small area of good land under plough husbandry with a pastoral occupation. Furthermore, the manure from produce grown on cultivated alluvials might with advantage be used to make fertile a small additional breadth of poorer forest land each year. Little by little should be the farmer's watchword, but let each little be done well. The local market at Hickey's Creek is very circumscribed, and Kempsey, the nearest port, is 28 miles away; so that it is desirable to have the products of the farm easy of transport. What with 28 miles haulage, freight and charges, 1s. 1d. has to be deducted from each bushel of maize, yet corn is the most suitable main crop of the farm. Pig-raising has been for the past twelve years a leading feature of Mr. O'Meara's management, besides which 400 head of cattle are carried on the run of nearly 1,000 acres; but when prices only average 10s. per annum increase on each beast, instead of a £1, as has hitherto ruled, it is evident that cattle do not pay now-a-days. Sheep being scarce in the North Coast district, Kempsey butchers ship their supplies from Sydney, mutton selling at 4d. per lb. If only a moderate flock comes down from the New England tableland the local market is glutted, for the annual consumption may be put at 800 sheep. The Kempsey forest country affords sweet, sound, and nutritious pasture; but if sheep were generally kept, there would be a difficulty in getting off the surplus.

The floods on the Macleay come suddenly, and the river rises to an extraordinary depth; at Bellbrook, within 3 miles of Mr. O'Meara's last June 63 feet was registered. The scour of that flood which was 30 feet over the growing maize was excessive, ten acres of Mr. O'Meara's cultivated alluvial disappeared, and a neighbour lost the whole of his flat. The country rock is slate, and the undulating ridges near the river soon rise into lofty mountain spurs. The soil on the ridge sides is fairly good, although thin on the top, whilst in the bottoms there are moderate flats of fair soil with water courses not for long dry.

The water frontage of the Maryvale farm to the Macleay and Hickey's Creek is extensive, so that the property forms an ideal mixed farm. The cultivated area, 40 acres in extent, is a narrow flat lying between a steep bank 50 feet high and the boulder bed of the river. The residence is 70 feet above summer level, and stands on the bank just mentioned, which forms the edge of the country proper. From the garden a view is obtained

of the narrow fringe of rich green maize lying immediately below and the wide desert-like stretch of boulders which forms the bed of the river, generally a very shallow narrow stream. The property was acquired twenty-one years ago under the 1861 Land Act, the flat and all the river frontage being selected together with two or three back blocks in 1875 and 1889 so as to run more cattle, making in all 1,033 acres. The alluvial was primarily covered with a dense heavy brush, and a large proportion of the forest country has been rung.

The deep porous sandy alluvial needs no drainage, whilst the grazing paddocks have such an extensive water frontage as to need no dams. The ridge lands overlie a clay, and if ever cultivated would need underground drainage. Rain-water is conserved in tanks at both the residence and farm buildings, the large underground cistern in the farm-yard being fitted with a pump and over-head tank, which commands the house and garden.

The grazing paddocks are few in number and large, varying up to 300 acres in extent. The fences are of three rail, substantial and well looked after, with gates to the roads leading to the homestead, and slip rails elsewhere.

The residence was put up twenty-one years ago when the property was selected, and consists of two cottages of weatherboard having a narrow fringe of flower garden in front, forming the especial care of an invalid daughter. The whole of the homestead was erected by Mr. O'Meara. The farm buildings consist of a large barn of slabs with iron roof, having an open cart shed at one end. The climate renders a stable unnecessary. There are extensive piggeries having bark or iron shelter to the styes with several large paddocks adjacent. For the poultry there is a good house and yard wired in, kept very neat and strewn with fresh ashes so as to keep down vermin. There is also a forge and workshop, Mr. O'Meara and his brother being both self-taught smiths and carpenters, and many implements and mechanical adaptations made at home testify to their skill.

The wood beam American type of plough is preferred with chilled digging breasts. The Avery Company's 2-furrow does the main work of the farm. A "Daisy Clipper" throwing a 14 in. x 12 in. furrow is much liked, as with three horses it will cover 1½ acres in a day. Hilling up is done by a Moline Company's No. 4 plough. Rowe, of Greenhill, near Kempsey, has supplied an ordinary iron 1-furrow, and one has been fitted with double mould boards for planting corn. A very light home-made plough is used for the garden. The iron plough is fitted to carry a home-made seed dropper with a simple adjustment to control the delivery, obtained by having a movable plug bottom to the cup-hole. The wood harrows and two rollers are home-made, likewise a wooden expanding duck-foot horse hoe, having a hilling mould board on one back tine, and a 6-in. disc coulter on the opposite side to keep the instrument straight, this being an adaptation of Mr. O'Meara's. In the barn there was a large corn-cracker by Richmond and Chandler, a "Veteran" corn-sheller and bagger driven by a horse gear. A small steel wheat mill by W. Corns, of Wolverhampton, a Bentall's chaff-cutter, a home-made arrowroot grater, and a barn truck completes the list. There was a dray and buggy, and a combined truck and slide carried on a pair of wheels. This arrangement was also home-made, and has proved most useful in taking posts, firewood, or any heavy weight. The workshop contains a selection of tools and a forge. There is also a small dairy fitted with a No. 7 hand Danish separator having a capacity of 30 gallons per hour, and it has given complete satisfaction.

No rotation of crops is pursued, maize being taken continuously on the alluvial flat. The area under corn was 39 acres, and the crop looked parti-

cularly well and clean, especial pains being taken to keep down weeds. Yet, owing to the flood, work was behindhand. The varieties sown were "Early Marsden," "Queen of the Prairie," "Red Hawkesbury," and "White Flint." The "Queen" was from last year's crop, the seed having at first been got from the Upper Macleay. The "Marsden" was from Wm. Tree's farm near Kempsey, who exhibited it at the local show, and this is the first season of its growth at Maryvale. The "Hawkesbury" seed came from a neighbour to whom Mr. O'Meara had previously given the variety, and he was desirous after the flood had washed away his crop to have the old strain back again. The land is ploughed in July and is followed by a second planting which takes place in September and October, the square set being preferred. The yield is from 50 to 60 bushels per acre, and the market is Sydney. The stalks are burnt. Some two years ago the question of hilling and not doing so was settled by experiment in favour of the former. Other crops are grown to a minor degree, ½ acre being under potatoes, ½ acre in oats for hay, also some Hungarian millet, which gives a good return. A small plot of beans showed well, and three long rows of tobacco, in all perhaps ¼ acre, were particularly healthy. The seed sown was "Broad Dutch," originally from California, and was given by a friend on the Manning. The leaf was bold and clean, but somewhat holed by grasshoppers. Every day the ripe leaves are picked, a small box in the barn suffices to ferment in, and a screw-jack is used to form a press. The leaf finds a ready sale locally at 6d. per lb. It is evident that tobacco as a crop suits the district. Pumpkins are sown generally throughout the maize, and squash amidst the early maize. "Early Rose" potato does well at Maryvale, and this season some "Conference Surprise" got from neighbours has been planted.

Farm-yard manure is made from sweepings from the cow-yard. That from the poultry pens is kept for use in the garden; while the maize stalks are burnt.

Fodder is not conserved, since there is no need for a store of it, by reason of the live-stock on the grazing lands being augmented or diminished according to the season.

The live-stock comprise 30 horses, 400 cattle, 43 swine, and 377 head of poultry. The horses are 7 heavy draught, 5 light for saddle and buggy, 8 blood yearlings, and 10 blood brood mares. The stock throughout is of a good character, but prices are low. This year 2 heavy draught have been sold at £9 each, and bloods fetch from £5 to £15 for hacks. The cattle number 400, and comprise 4 bulls, 33 milkers, 66 dry and springers, and 300 head on the run. The sales are local and to Maitland buyers, but the prices are very low, £2 being got for a three-year-old beast. Mr. O'Meara does some butchering, killing about 25 beasts per annum, and the meat is sold locally at 2½d. per lb. The calves run with the cows for half the day, from 7 a.m. to 2·30 p.m. The morning milk is put through a hand separator and made into butter. Some cheese is also made, both butter and cheese are sold locally and in Kempsey, the former fetching seldom over 1s. per lb., and the latter from 5d. to 6d. per lb. A cheese-press has ingeniously been made out of a linen-press, and one dairy serves for both butter and cheese. Pig feeding has for twelve years past been a feature of Mr. O'Meara's farming, and was resorted to because of the difficult haulage of maize to market. There are extensive paddocks and a topping-up yard attached to the piggery. At first bacon-curing was relied on, 6d. per lb. being got locally, but there is less trouble in selling the pigs alive in Sydney. A drover takes them to Kempsey when from four to six months old; freight to Sydney is 2s. per head, and from 18s to 26s. are realised. The number kept is generally about 200 head, the food being pumpkins, squash, and inferior maize, together with the herbage

in the paddocks. Improved Berkshires are preferred, a boar and twelve sows forming the breeding-stock. The flood having destroyed the food supplies, only thirty stores were in hand last December. A number of fowls are kept, a mixture of many breeds, eggs and table-birds being disposed of for barter with itinerant dealers. In addition to 250 fowls and 80 chicks, there were 7 geese and 40 ducks. About three years ago a start was made in bee-keeping, and the present stock consists of 8 Italian hives and 42 black bee; already ½ a ton of honey has been got, and about 30 cwt. more may be expected. Sales are made locally at 6d. per lb., 10 cwt. having already been disposed of. Hive material is obtained from Sydney, and Mr. O'Meara has cleverly utilised the gearing of a discarded Wanzer sewing-machine to run the extractor with increased evenness and rapidity.

Sufficient vegetables for home use are grown on the flat. On the slope of the 50-foot bank, on which the house stands, is placed the orchard, where citrus-trees and peaches grow famously, and top 25 feet in height, the deep sandy silt forming a soil most suitable. Flying-foxes are a pest, and in order to protect the fruit 30-foot scaffold-poles have been erected on the four sides, and six barb wires, at intervals of 18 inches, commencing at the top of the pole, have been stretched. The remains of skin show where the pests have been entangled. A few oranges are sold, and Mrs. and the Misses O'Meara make capital preserves.

The book-keeping consists of entries of sales and purchases.

The labour of this 40-acre plot of cultivation ground and nearly 1,000 acres of run is accomplished by Mr. O'Meara, but since July a brother has assisted, owing to illness in the family having interfered with Mr. O'Meara's continuous attention. A stout lad is employed, and there are no sons on whose labour to rely in the future.

The subsidiary aids may be enumerated as co-operative family labour; sales of butter and cheese; also the exchange of eggs and table-fowls for goods; home carpentry, smith's work, shoeing, implement-making and building.

The points of interest are, a mixed farm comprising a large run and small area of cultivated land wholly attended to by one man; the excellent culture of the arable area, pig-raising on an extensive scale, tobacco-culture, hand-separator, and barb wire to orchard.

The management, with a view to profit, is based on the growth of maize, sales of fat pigs, and running cattle on 1,000 acres of ring-barked country. This mixed husbandry has proved its value during the past year when a flood swept away the maize crop. In the aggregate a fair number of acres scattered in favourable spots over the run might be ploughed, but the area now under crop is quite as much as one man can attend to. It is possible that were the property divided into three farms, each with 40 acres of cultivation land, the returns would be threefold what they now are; but to hire labour for that purpose would probably yield no profit at all. This farm is typical of a very large area in New South Wales, and the good cultivation displayed, and the self-reliance and mechanical skill possessed, have overcome the difficulties entailed by an isolated situation with difficult and costly land carriage. The land was acquired by *bona-fide* selection, and might be valued at £2,500; with all improvements it probably would realise more, whilst homestead, live stock, and working plant may be put down at £1,100, making £3,600 in all. The annual turnover may be taken at £725, composed of maize £250, run cattle £200, horses £25, pigs £200, and sundries £50. These figures suffice to show that mixed farming on Mr. O'Meara's lines is a profitable undertaking.

(In the next *Gazette* will appear the report on the farms under 200 acres.)

MIXED FARMS not exceeding 1,280 acres and over 200 acres.

	Points.	Worboys, T. C.	Wilford, W. H.	Warden, A. F.	Mason, Dr. H. W.	Godfrey, G., senior.	Sommerlad, J. H.	O'Meara, W.
System of underground drainage*	50*	....	50	....	49	50	45	....
Conservation of water, and its economical application...	80	60	36	60	70	70	60	60
Character and condition of fences, gates, &c.	40	36	39	39	26	27	34	29
Plan, character, and condition of farm-house, buildings, &c.	40	39	35	38	33	34	33	31
Kinds of implements, condition, &c.	60	60	57	60	59	58	56	55
System of cultivation, rotation, &c.	80	79	79	79	74	74	76	78
State of crops as to cleanness and cultivation ...	100	99	98	97	95	95	92	96
Productiveness of crops	50	49	50	49	49	49	48	50
Conservation of manure made on the farm	50	49	42	42	47	41	45	31
System of manuring*	50*	....	....	....	....	....	....	....
Means used for conserving fodder	60	50	45	47	50	48	37	28
System of laying down grasses	20	15	20	20	20	17	15	5
Class and condition of stock	50	49	50	50	50	48	41	47
Vegetable and fruit garden	25	23	23	23	14	15	25	16
Mode of book-keeping	20	16	15	15	11	7	8	7
Number and condition of subsidiary aids to farm ...	80	72	59	61	56	64	59	56
Any new point of interest and commercial value, such as new crops, ensilage, &c.	20	16	12	14	18	14	14	12
General management, with a view to profit	125	115	119	110	109	112	113	118
Total points	1,000	827	858	804	830	823	801	719
Highest number of points*...	....	900*	950*	900*	950*	950*	950*	900*
Percentage of points	....	91·18	90·31	88·22	87·36	86·73	83·26	79·77

* NOTE.—The prizes will be awarded to the entries gaining the highest percentage of excellence—not necessarily the greatest total of points. Thus, in the event of any of the improvements indicated with an asterisk (*) being deemed by the judge unnecessary on any competing farm, the points allotted to that subject will not be included in the *total maximum* of points, and the *percentage of excellence* will be calculated accordingly. Thus, a competitor who gains 760 points on a farm that is judged to need artificial drainage would receive a mark of excellence, 760 out of a possible 1,000—equivalent to 76 per cent.; but a competitor gaining the same number of points on a farm that is judged to need *no* artificial drainage would receive a mark of excellence, 760 out of a possible 950—equivalent to 80 per cent.

MIXED FARMS not exceeding 1,280 acres and over 200 acres.

Order of merit.	Competitors.	Drainage.					Water conservation.						Fences, gates, roads.									Homestead.							
		Area.	Drains.	Difficulty.	Special merit.	Total.	Household.	Farmstead.	Paddocks.	Irrigation.	Water-power.	Total.	Style of fence.	Condition of fence.	Condition of gates.	Condition of roads.	Gates or slip-rails.	Hedges, stone walls.	Trees planted.	Special merit.	Total.	Plan, farmhouse.	Character, farmhouse.	Condition, farmhouse.	Plan, farm buildings.	Character, farm buildings.	Condition, farm buildings.	Special merit.	Total.
		15	15	15	5	50	20	20	20	10	10	80	5	5	5	5	5	5	5	5	40	6	6	6	6	6	6	4	40
1	Worboys, T. C.	...	...	...	...	...	20	20	20	...	...	60	4	5	5	5	4	5	4	4	36	6	6	6	6	5	6	4	39
2	Wilford, W. H.	15	15	15	5	50	20	20	20	5	...	65	5	5	5	5	4	5	5	5	39	6	6	6	4	4	6	3	35
3	Warden, A. F.	...	...	...	...	...	20	20	20	...	...	60	5	5	5	5	4	5	5	5	39	6	6	6	6	4	6	4	38
4	Mason, Dr. W. H.	15	15	15	4	40	15	15	20	10	10	70	5	5	5	5	3	...	...	3	26	4	4	4	6	5	6	4	33
5	Godfrey, G., senr.	15	15	15	5	50	20	20	20	10	...	70	5	5	5	5	4	...	...	3	27	6	6	6	5	3	5	3	34
6	Sommerlad, J. H.	15	10	15	5	45	20	20	20	...	...	60	5	5	5	5	4	2	5	3	31	4	4	6	5	4	6	4	33
7	O'Meara, W.	...	...	...	...	...	20	20	20	...	...	60	5	5	5	5	4	...	...	5	29	4	4	4	6	4	6	3	31

MIXED FARMS not exceeding 1,280 acres and over 200 acres.

Names.	Implements.						System of cultivation and rotation.									Cleanness and cultivation.								Productiveness.				
	Tillage.	Harvest.	Marketing—Dairy.	Vehicles—Harness.	Special merit.	Total.	Cereals.	Hay crops.	Fodder crops.	Potatoes and Pumpkins.	Special—Tobacco, Cane, Melons, &c.	Special merit.	Rotation.	Special merit.	Total.	Cleanness of cultivation.	Few rank weeds.	Clean fences.	Clean headland.	Special merit.	Method of cultivation.	Special merit.	Total.	Cereals.	Fodder—Pumpkins, grass.	Potatoes, cane—special.	Special merit.	Total.
	15	15	15	10	5	60	10	10	10	10	10	10	10	10	80	40	5	5	5	5	30	10	100	15	15	15	5	50
Worboys, T. C.	15	15	15	10	5	60	10	10	10	10	10	10	10	9	79	40	5	5	5	5	30	9	99	15	15	15	4	49
Wilford, W. H.	15	15	15	10	2	57	10	10	10	10	10	10	10	9	79	40	5	4	5	5	30	9	98	15	15	15	5	50
Warden, A. F.	15	15	15	10	5	60	10	10	10	10	10	10	10	9	79	40	5	4	4	5	30	9	97	15	15	15	4	49
Mason, Dr. H. W.	15	15	15	10	4	59	10	10	10	10	5	10	10	9	74	40	3	4	4	5	30	9	95	15	15	15	4	49
Godfrey, G., senr.	15	15	15	10	3	58	10	10	10	10	5	10	10	9	74	40	3	4	4	5	30	9	95	15	15	15	4	49
Sommerlad, J. H.	15	15	15	10	1	56	10	10	10	10	10	8	10	8	76	40	4	4	4	3	28	9	92	15	15	15	3	48
O'Meara, W.	15	10	15	10	5	55	10	10	10	10	10	10	10	8	78	40	4	5	5	4	30	8	96	15	15	15	5	50

Mixed Farms not exceeding 1,280 acres and over 200 acres.

Names.	Manures.									Conserving fodder.												Grass land.			Live stock.					
	Farm-yard stables.	Farm-yard cows.	Farm-yard pigs.	Farm-yard fowls.	Field-ploughed.	Rubbish gathered.	Mud, silt, and fertilisers.	Special merit.	Total.	Resting grass paddocks.	Grass hay.	Cereal hay.	Ensilage.	Mowing machines.	Food preparation, &c.	Horse power.	Barn.	Hay-shed.	Stacks.	Special merit.	Total.	Condition of pasture.	Special merit.	Total.	Plough-horses.	Light horses.	Cattle.	Swine.	*Sheep and special merit.	Total.
	5	5	5	5	5	5	5	15	50	5	5	5	10	5	5	5	5	5	5	5	60	15	5	20	10	10	10	10	10	50
Worboys, T. C.	5	5	5	5	5	5	5	14	49	5	5	5	...	5	5	5	5	5	5	5	50	10	5	15	10	10	9	10	*10	49
Wilford, W. H.	5	5	5	5	5	5	...	12	42	5	5	5	...	5	5	5	5	5	...	5	45	15	5	20	10	10	10	10	10	50
Warden, A. F.	5	5	5	5	5	5	...	12	42	6	5	5	...	5	5	5	5	5	3	4	47	15	5	20	10	10	10	10	*10	50
Mason, Dr. H. W.	5	5	5	2	5	5	5	15	47	5	3	5	2	5	5	5	5	5	5	5	50	15	5	20	10	10	10	10	10	50
Godfrey, G., senr.	5	5	5	5	3	3	2	13	41	5	5	5	...	5	5	3	5	5	5	5	48	12	5	17	10	10	9	10	9	48
Sommerlad, J. H.	5	5	5	5	3	5	5	12	45	3	2	5	...	5	5	3	5	5	4	...	37	10	5	15	10	9	7	9	6	41
O'Meara, W....	4	3	4	5	3	...	...	12	31	...	...	5	...	...	5	3	5	5	...	5	28	5	...	5	10	10	9	10	8	47

MIXED FARMS not exceeding 1,280 acres and over 200 acres.

Names.	Garden & Orchard.				Book-keeping.					Subsidiary aids.																					
	Kitchen garden.	Orchard.	Special merit.	Total.	Sales and purchases.	Ledger.	Farm data.	Balance-sheet.	Total.	Labour—Family.	Do. building	Do. Implement making.	Do. Light repairs.	Do. Heavy repairs.	Sales of dairy produce.	Do. poultry produce.	Do. honey.	Do. vegetables.	Do. fruits.	Do. cereals seed.	Do. garden seed.	Do. potatoes for seed	Do. nursery stock, grass, cane, &c.	Do. live stock.	Hire of implements, &c.	Meat and bacon.	Pig-breeding.	Poultry-keeping.	Butter-making.	Power—horse, water, steam.	Total.
	10	10	5	25	5	5	5	5	20	2	2	2	2	2	2	2	2	2	2	2	2	2	4	10	10	5	5	5	5	10	80
Worboys, T. C.	10	9	4	23	5	5	5	1	16	2	2	2	2	2	2	2	...	2	2	2	...	2	2	8	10	5	5	5	5	10	72
Wilford, W. H.... ...	10	9	4	23	5	5	5	...	15	2	2	2	2	2	2	2	2	1	2	2	...	1	2	10	...	5	5	5	5	5	59
Warden, A. F.	10	9	4	23	5	5	5	...	15	1	2	2	2	2	2	2	...	2	2	2	...	1	2	9	..	5	5	5	5	10	61
Mason, Dr. H. W. ...	2	8	4	14	5	3	3	...	11	...	...	1	2	1	2	2	...	1	2	2	...	...	...	10	5	3	5	5	5	10	56
Godfrey, G., senr. ...	8	5	2	15	5	...	2	...	7	2	2	2	2	2	2	2	...	1	1	2	...	2	...	9	10	5	5	5	5	5	64
Sommerlad, J. H. ...	10	10	5	25	5	...	3	...	8	2	2	2	2	2	2	2	2	2	2	2	2	2	3	7	...	5	5	5	3	5	59
O'Meara, W.	4	8	4	16	5	...	2	...	7	2	2	2	2	2	2	2	2	1	2	2	...	...	...	10	...	5	5	5	5	5	56

MIXED FARMS not exceeding 1,280 acres and over 200 acres.

Names	Points of interest.																	Management with a view to profit.										
	Experimental culture.	Nursery culture.	Fruit-culture.	Vegetable-culture.	Any new crop.	Power, steam or water.	Superior implements of tillage.	Superior implements of harvesting.	Tool-shop.	Superior dairy.	Ensilage.	Green crops.	Superior pasture.	Laying down pasture.	Superior hay-barns.	Special merit.	Total.	Tillage.	Cropping.	Live stock.	Marketing of farm produce.	Marketing of dairy produce.	Marketing of orchard produce.	Co-operative labour.	Home repairs, &c.	Class of machinery.	Special merit.	Total.
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	5	20	10	10	10	10	10	10	10	10	10	35	125
Werboys, T. C.	1	...	1	1	1	1	1	1	1	1	...	1	...	...	1	5	16	10	10	10	10	6	5	10	9	10	35	115
Wilford, W. H.	...	...	...	1	...	...	1	1	1	1	...	1	1	1	1	3	12	10	10	10	10	10	5	10	10	9	35	119
Warden, A. F.	1	...	...	...	1	1	1	1	1	1	...	1	1	1	1	3	14	10	10	10	10	10	...	5	10	10	35	110
Mason, Dr. H. W.	1	...	...	1	1	1	1	1	1	1	1	1	1	1	1	5	18	10	10	10	9	10	8	...	7	10	35	109
Godfrey, G., senr.	...	...	...	...	1	...	1	1	1	1	...	1	1	1	1	5	14	10	10	8	10	8	4	10	9	9	34	112
Sommerlad, J. H.	1	1	1	1	...	...	1	1	1	1	...	1	...	1	...	4	14	10	10	7	10	9	10	10	8	9	30	113
O'Meara, W.	1	...	1	...	1	...	1	1	1	1	...	...	...	...	...	5	12	10	10	10	10	10	10	10	10	8	30	118

Spraying Experiments at Rookwood.

By A. H. BENSON,
Fruit Expert.

THE orchard attached to the Government Asylum at Rookwood having been placed at the disposal of the Department of Agriculture for the purpose of carrying out a series of experiments with different insecticides and fungicides, a meeting of the Pomological Committee was held there on Friday, 4th August, 1892, for the purpose of noting the condition of the trees, and of selecting and marking those which were to be experimented upon.

Those trees, as well as others that were subsequently chosen, have been sprayed once or oftener with various remedies, with the following results:— The first spraying was done on 24th August, the day being fine and the sun somewhat scorching at intervals, but there was little wind. Six apricot-trees were first sprayed for the shot-hole fungus, three trees being sprayed with the Bordeaux Mixture, and three trees being sprayed with the IXL Remedy. All the trees sprayed were on the point of bursting into flower, and received a thorough spraying. It was my intention to spray these trees again just as the fruit was setting, but other official business prevented my doing so, so that the trees were sprayed only the once. The result of the spraying with the Bordeaux Mixture has been very satisfactory, one of the trees sprayed being quite free, and the other two only slightly affected. The IXL Remedy was not as efficacious, though the trees are certainly less diseased than those unsprayed.

Five pear-trees were next sprayed with the same remedies—two with the Bordeaux Mixture and three with the IXL—for pear scab (Windsor pear blight), the trees, in addition, having a quantity of lichen growing on them and a few greedy scales (*Aspidiotus rapax*). It was intended to spray these trees again just as the fruit was setting, but, like the apricots, they only received the one spraying. The lichen growing on the trees was killed by both remedies, and the trees sprayed with the Bordeaux Mixture are certainly freer from pear scab than most of the trees unsprayed, but this remedy failed to kill the scales. The IXL Remedy, however, killed a portion of the scales, and had apparently a good effect on the scab, as the trees are not badly affected.

Five pear-trees badly affected with greedy scales were next sprayed, the remedy used being "Rovery's Scale Blight Exterminator," applied at the strength recommended in the directions supplied with the remedy—that is, 1 quart tin to 6 gallons. At this strength it is certainly too strong, and I should advise 10 gallons in the place of 6, as the strongest that it is safe to use it without fear of injuring the trees. The remedy contains arsenic in a

soluble form, and is very caustic. It is certainly death to all scales, as black and greedy scales were dried right up in forty-eight hours, but it will have to be used with great caution and very much diluted when the leaves are out, as at the strength used I found it killed all the weeds that the spray got on to. At the strength used two of the trees were injured, fully one-third of the buds being killed.

The Lisbon lemon trees, one orange, and one Emperor mandarin were next sprayed with kerosene emulsion—1 gallon of kerosene in 16 gallons of emulsion—for various scale insects with which they were very badly infested. No injurious effects were caused by using the emulsion at this strength, and the application was repeated on 6th September. A large number of scales were killed by the two applications, but not all.

The next trees sprayed were a shaddock, a scarlet mandarin, two Emperor mandarins, a thorny mandarin, and a cumquat, the remedy in this case being the resin, soda, and fish-oil wash (No. VIII, Insect and Fungus Pests, Pamphlet), as recommended for citrus-trees. These trees were badly infested with several varieties of scales, and were only sprayed the once, and the result is more satisfactory than the two sprayings with the kerosene emulsion, as far as the number of insects killed is concerned, but a number of leaves were thrown down by its use. The whole of the citrus-trees experimented upon were a very unsatisfactory lot to treat, as they were more dead than alive, the cold undrained clay in which they are planted being unsuited to their growth, and the scales were so thick on them as to form a kind of outer bark on all the branches.

Five peach-trees, badly infested with peach aphis, were next sprayed with the resin and soda wash, using a triple cyclone nozzle, so as to reach as many of the insects as possible. The trees were just budding out, and an occasional flower showing, and every bud was covered with aphis. Many trees adjoining those sprayed were infested, so that although the remedy destroyed large numbers of the insects, they multiplied so rapidly that the spraying did little to keep them in check, even though these same trees were resprayed on the 25th, and again on the 29th. The spraying on the 25th was done with a Nixon nozzle, using as much force as possible, the object being to see if the insects could not be clean washed off the trees, but the results were not more satisfactory than when the triple cyclone nozzle was used, and as the latter is more economical to use, that is to say, will cover a tree completely with less material than the Nixon, it is the best to use in this case.

The following day, 25th August, spraying was continued, the weather being fine, but rather windy. The five peach-trees just mentioned were again sprayed, and one other peach-tree, the Flat China, which was more advanced than the others, and which was completely covered with aphis, was sprayed with Upfold's Tree-pest Exterminator—1 gallon in 5 of mixture—with the result that large numbers of aphides were killed, but both the leaves and fruit were scorched more or less, showing that this remedy should not be used at as great a strength on peach-trees, nor should it be applied on a windy or sunny day. This tree was not sprayed again, but when lately examined, though apparently nearly dead, every bit of young growth was covered with aphis.

Four pear-trees, badly infested with greedy scale, were next sprayed with the resin, soda, and fish-oil remedy (winter strength for deciduous trees), and this dressing was repeated on 6th September. The result of these two applications is that the trees were not injured in any way, but all the scale insects were killed. This remedy has, however, no effect as a fungicide, as the trees sprayed are badly attacked with pear-scab.

Three pear-trees were next sprayed with Redwood's Specific, as per instructions sent with the wash. The trees were covered with greedy scale, which were seemingly uninjured by the dressing, and the trees are badly affected with pear-scab.

Eight apple-trees, badly blighted with the American blight, or woolly aphis, were next sprayed—four with Upfold's Mixture, and four with the resin and soda wash. The Upfold's Mixture was used at a strength of 1 gallon in 5 of the mixture, and the resin and soda of the strength recommended by the Department. Both remedies were applied by means of the Nixon nozzle, the insects being completely swept from the tree and killed outright. On the 6th September, a few specks of the insects being seen, the trees were again sprayed and completely cleared, both remedies being efficacious in destroying the insects. These trees on being lately examined were found to be nearly as bad as if they had not been touched, showing that these remedies simply keep off the insects for the time being, and unless all the trees in the orchard are dressed, and the insect is kept in check, whenever and wherever it makes its appearance, they will not be entirely efficacious. The trees sprayed were surrounded with dirty trees that were not sprayed, so that the insects returned in the winged form from them and rapidly spread.

Four pear-trees, badly affected with greedy scale, were next sprayed with the Victoria Tree-wash, and the application was repeated on 6th September. This remedy seems to have had no effect, beneficial or otherwise.

The third spraying took place on 29th August, the day being fine for the first part, and showery later on. Five peach-trees were first sprayed with the resin and soda wash for the third time, then a single peach-tree was thoroughly sprayed with a strong solution of soft-soap and water, applied hot, and with as much force as possible, but the effects were no more satisfactory than the other remedies. Seven peach-trees were next sprayed with Upfold's Mixture, one part in five, but the results were no better than those obtained by using the resin and soda wash.

The fourth and last spraying was done on 6th September, the weather being somewhat showery, and the sprayings consisted in second applications of kerosene emulsion on citrus-trees; Victoria Tree-wash on pears; resin, soda and fish-oil wash on pears; and the resin and soda and Upfold's Washes on the apples for woolly aphis. No peach-trees were sprayed, as the day was not suitable.

The general results of the spraying may be briefly summarised as follows:—

First.—Scale insects on deciduous trees were effectually destroyed by spraying once with Rovery's Scale Blight Exterminator, and by spraying twice with the resin, soda, and fish-oil wash. The IXL Remedy partly destroyed the scales, but the Victoria-tree Wash, Bordeaux Mixture, and Redwood's Specific destroyed few, if any. Second.—Scale insects on citrus-trees were treated fairly successfully with two sprayings of kerosene emulsion (1 in 16), and with one spraying of the resin, soda, and fish-oil wash. The latter remedy proved most efficacious, but it is apt to throw down the leaves if applied on a hot or windy day, and it should only be used when the tree is partially dormant, and not when it is making new growth. Third.—Shot-hole fungus on the apricot is prevented by the use of the Bordeaux Mixture, applied just as the fruit-buds are bursting. A second application, just as the fruit is setting, in most cases will be all that is necessary. Though only one application was made, the results were satisfactory. The IXL Remedy had also a beneficial effect, but not equal to that produced by the Bordeaux Mixture. Fourth.—Pears sprayed with the Bordeaux Mixture and the IXL Remedy were less affected with pear scab (Windsor-pear blight),

on the foliage than trees that were not sprayed, but I could not see that any effects were produced on the scab by the Victoria Tree-wash, Redwood's Specific, resin, soda, and fish-oil wash, Rovery's Scale Blight Exterminator.

Fifth.—Both Upfold's Tree-pest Exterminator and the resin and soda wash killed the peach aphis, but neither remedy was altogether satisfactory. Neither remedy can be applied when the tree is in bloom, or even when the flower-buds are bursting, without injury, and they can only be applied on a dull day, or during the evening, or the young leaves and fruit will be injured. These remedies are likely to be of most value when used to kill the insects that are found on the trees during winter, as, if these are killed off then, the trees will have a better chance, as the buds will get a start before the insects are sufficiently numerous to destroy them. In the case of these insects the great harm is done just as the buds are bursting, when in bad cases every particle of young growth is completely covered with insects, and often destroyed by them.

Sixth.—Both Upfold's Mixture and the resin and soda wash will completely destroy all woolly aphis for the time if applied with force and by means of the Nixon nozzle, but in order to be thoroughly successful the whole orchard must be cleaned, and the insects persistently fought, whenever and wherever they may be found, when, if the orchard is not surrounded by dirty and neglected orchards, the woolly aphis will not give much trouble—of course, taking for granted that the roots on which the trees are worked are clean. The pump used for carrying out the experiments was a Nixon No. 3, and the nozzles used were the Nixon and the triple cyclone. Only one line of hose was used, the spray being always applied with as much force as possible, and in order to distribute the spray easily, evenly, and economically, a 7-foot bamboo extension was used. Throughout the experiments the pump and nozzles worked satisfactorily.

Cider.

By ALBERT H. BENSON,
Fruit Expert.

The manufacture of cider as a subsidiary aid to the fruit-growing industry of this Colony has been entirely neglected by our fruit-growers, and yet it is an industry that is well worth the careful attention of our fruit-growers, especially those of the colder districts of the Colony, and also those of districts that are far from a market, and where the expense of marketing the fresh fruit takes all the profit, so that, rather than run the risk of a probable loss, the grower often allows the fruit to lie under the trees and rot. In many of the colder districts of this Colony the apple grows in the greatest profusion and to the greatest perfection, and that often with very little care being bestowed either on the pruning of the trees or cultivation of the orchard, and it is here especially that the growing of the best kinds of cider apples and the manufacture of cider should prove a paying industry. One of the chief reasons that cider has not been made in any appreciable quantity is, I believe, the want of suitable varieties of apple, and not the want of the knowledge of how to make it, as amongst our fruit-growers there are many Hereford, Devon, and Somerset men, who are thoroughly acquainted with its manufacture in the Old Country. In order that suitable varieties of cider apples may be obtained in this Colony, I may state that it is the intention of the Department of Agriculture to obtain a number of the best varieties of cider apples, which will be planted out at the experimental farms, and scions from them will be distributed to fruit-growers who are desirous of testing them.

By cider, I mean the pure unadulterated juice of the apple, made from sound ripe fruit, and sufficiently fermented to keep sound, and yet not to be of a highly intoxicating nature—in fact, a drink that is admirably suited to the requirements of this climate, and one that is far better, more wholesome, and more thirst-quenching than the heavy imported beers and spirits so largely used.

The making of cider is not at all a difficult matter, provided that proper care and attention is given to it, that it is made from suitable fruit that is sound, clean, and thoroughly ripe, and that the mill-press, fermenting-vats, and casks are kept scrupulously clean. Cider-making is in many respects very similar to wine-making, and to anyone going in for it I cannot give better advice than to recommend them to carefully peruse the articles on wine-making, and the treatment of the wine in the cellar, by Mr. J. A. Despeissis, that have appeared in the *Agricultural Gazette*.

Though cider of a kind may be made, and often is made in England, from a general mixture of all the different kinds of apples grown in an orchard, yet, if a first-class article is required, the varieties must be selected, and not only selected, but they must be mixed together in the right proportion, which varies with different soils. The best soil for cider is a reddish or brownish loam of medium texture, with a clayey loam or marly loam subsoil. Gritty or gravelly soils are not suitable, as they produce a thin, poor cider of light colour—usually very acid—and often keeping badly. The

necessary qualifications of a good cider apple are, a large amount of juice, rich in sugar, a soft flesh that is easily crushed, a highly-coloured juice, or bright red skins to give colour, and a strong-growing and prolific tree as free as possible from woolly aphis. When tested, some of our local seedlings are likely to prove of value, notably a very showy local apple called Jupp's Surprise, which has all the qualities of a good cider apple.

Should, however, any fruit-grower like to test the cider-making qualities of the apples he is growing, rather than allow them to go to waste, he may easily do so, and in order to describe the process of its manufacture, I will endeavour to show as briefly as possible the whole business of cider-making, as conducted in the South of England. and in which I have many times assisted. The apples when ripe are allowed to fall from the trees, the fall as a rule being to a great extent lessened by the grass growing under the trees, but here it will be advisable to lay straw or sheets under the trees, so as to break the fall, and prevent as much bruising as possible, the trees being then shaken sufficiently to detach all ripe fruit, but not so hard as to shake off the unripe.

In order to make good cider, the bruising of the fruit should be prevented as much as possible, as bruised fruit rots, and rotten fruits imparts a bad flavour to the cider if present in any quantity.

After the fruit has either fallen or has been shaken down, it is gathered up and placed in large heaps to thoroughly ripen, when it is taken to the mill and crushed. The mill is worked either by hand or by power, usually the latter, and it consists of two pairs of rollers. A smaller pair of fluted iron rollers through which the fruit passes first, and which cut and crush the fruit, after which it passes through a pair of heavy granite rollers, and is thoroughly crushed, so as to allow the juice being readily extracted. The pummice, as the crushed fruit is now called, is next placed in the press, and built into what is termed a cheeze, which consists of usually six or seven layers of pummice, from 7 to 8 inches thick, which are kept in place, one on top of each other, by means of hair-cloths made for the purpose, or by clean wheat straw, if straw is used. The cheeze is made as follows:—A collapsible square framework the length and breadth of the cheeze to be made is placed on the bed of the press, and a quantity of pummice is placed within it, and evenly distributed. Next, a quantity of clean, sweet, wheat straw, which has been carefully shaken to remove all dust and superfluous cavings, is placed evenly round the framework, about half of its length being allowed to protrude all round outside of the framework. More pummice is then placed on the straw till the framework is tightly filled, the pummice being pressed with the hand into all crevices. The straw overlapping the frame is now turned in and kept in its place by placing a little more pummice on it, and the first cake of the cheeze is completed. The framework is now raised and kept in its place by means of sharpened sticks about 1 inch in diameter, and 16 to 18 inches long, which are inserted into the lower cake. The operation is repeated till there are six or seven cakes in the cheeze, which is usually as many as the press will hold. The cover of the press is now placed in position, but the press is not tightened, or only sufficiently so to keep the cheeze from slipping. Usually the cheeze is not pressed for some hours after it is built, as the colour of the cider is improved thereby. The presses used are fitted either with single or double screws, and the pressure is applied by means of long levers acting directly on the screws, so that a very strong pressure can be obtained. After the first pressing the cheeze is trimmed usually with a sharp hay-knife, the trimmings being broken up and placed on the top of the cheeze, where they are kept in position by straw

bands, and the cheeze is again pressed. The pressings and trimmings are continued till no more cider can be extracted, when the refuse is usually thrown on the manure-heap. Some makers keep the first pressing by itself, as it is the best of the cider, and the second and subsequent pressings are kept for the use of the men working on the farm. In this case, after the first pressing the cheeze is taken right down and built up again, a quantity of water flavoured with hops being poured over it, and the whole again tightly pressed. When hair-cloths are used the operation is simpler than with straw, and the cider is more rapidly extracted, but great care must be taken to see that the cloths are kept scrupulously clean. The juice, as expressed from the cheeze, runs into a large trough or tub, from whence it is taken to the fermenting-vats, which hold, as a rule, from 150 to 200 gallons. Before placing the juice in fermenting-vats it is strained through a hair sieve, so as to keep back as much extraneous matter as possible. The juice is allowed to remain in the fermenting-vats about three days, or rather till the thick scum which rises to the surface commences to crack, when it is time to draw off the cider and check the fermentation. On removing the cider from the fermenting-vats it is placed in thoroughly sweet and clean casks, which are filled up to the bung, which is not closed at first. A slight fermentation will still continue, and if any working takes place through the bung the cask must be kept full by more cider being added to make good the loss. After about three weeks the cider will stop working and get clear, a sort of glaze or crust forming on the surface. It must now be racked at once into another perfectly sweet cask, which must be quite filled. The bung should be lightly put in at first, and if after a few days working has ceased, driven tight, but a spile-hole should be left open for a day or two longer, and if there is then no appearance of the cider working it must be driven tight. Should, however, the cider continue to work it must be again racked, as it is only by racking that the fermentation can be stopped. A little charcoal is sometimes placed in the cask now. The cider should now be allowed to stand in a cool cellar till spring, when it must be again racked, as at the time of the apple blossoming it will start working. If not clear now, and it is wished to bottle it, a little isinglass or Spanish clay is added, which will soon clear it. Bottling should be done now, at the spring working, as the cider will thereby be sparkling, but if not bottled till later it will be quite still. In bottling sparkling cider do not cork as soon as filled, but allow the bottles to remain open for an hour, when cork and wire carefully, storing the bottles in a cool cellar, packed, if possible, in dry sand. Well-bottled sparkling cider is not to be despised, and thousands of dozens, after manipulation to produce the right colour, are sold annually in England as genuine champagne, and often take a very good judge to detect them.

Cider requires to be kept in a cool and well-ventilated cellar, and all the utensils, casks, &c., should be kept perfectly clean. All casks after having had cider removed from them should have the lees removed and be thoroughly washed out. If sour, boiling water containing carbonate of soda should be used, and if not perfectly sweet or casky they should be sulphured. The same attention that is necessary in the case of wine-casks is necessary in the case of cider-casks.

The cider that is not bottled should be sold after the spring racking and used, as it is not desirable to keep it longer than a year, as old cider in wood usually gets very hard and sour, and often ropey. From hard and sour cider very good vinegar can, however, be made—a vinegar that is only surpassed by that made from wine.

Poultry.

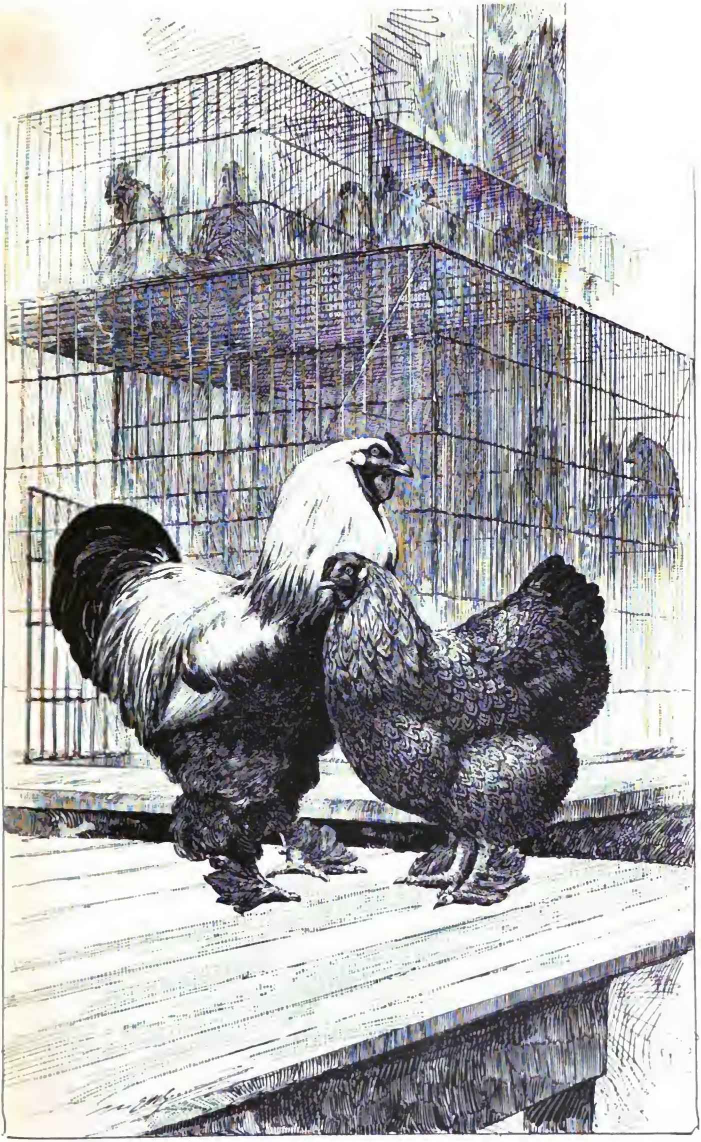
BY SAMUEL GRAY,
Sub-Editor.

BRAHMAS.

THIS is another breed as to which a most bitter controversy raged for years after the first appearance of some specimens. Without going into the merits of the case for either party, it may be stated that whereas, on the one hand, the Brahma was claimed as being of Chinese origin, and related to the Cochin family, other fanciers claimed it as a purely Indian breed. After a careful perusal of the *pros* and *cons.*, I have come to the conclusion that the birds did come from the banks of the Brahmapootra, in India, and were landed in New York somewhere about the year 1846, and that they are an entirely distinct breed from the birds known to us as Cochins. This is the more readily apparent from a comparison of the earlier types before our fanciers had sacrificed almost every beneficial characteristic to feather. Even at the present day the Brahma has not been bred to that excess of feather which is considered so necessary in the case of the modern Cochin, making due allowance for the softer feathering of the latter, but I am confident that the exhibition Brahma of to-day is neither so hardy nor such a good layer as the earlier specimens were found to be.

There is still another point in connection with Brahmas which it is necessary briefly to refer to. A doubt is prevalent as to whether or not the light and dark Brahmas are of the same origin. From inquiry and reference I incline to the belief that both light and dark varieties were obtained by means of selection from birds of the same original stock, and that careful breeding has succeeded in firmly establishing the two varieties.

This breed is one which owes its present high position to American breeders, there being not the slightest doubt that the first specimens which came to England were obtained from America. It is interesting to note that the American type of Brahma, even at the present day, is a much closer and less fully-feathered bird than that which takes prizes at English shows, although, to judge from the action of American fanciers in the case of Cochins, there is some fear that they will gradually adopt the English feathering, and so, in my opinion at least, render the bird less useful than ornamental. The weight and shape of both varieties are now about the same. The former is claimed to run higher than any other breed of fowls, even Cochins, a full-grown cock requiring to tip the scale at 12 lb., while a cockerel at 6 months old should weigh a least 7 lb. to 9 lb., and pullets 6lb. to 8 lb., and in each case the American weight may be taken as a little heavier. As regards shape, the chief distinction from the Cochin type is a longer and more arched neck, and the fanlike tail, although there are other less prominent differences, which will be noted on reference to the more detailed description which is appended. Speaking generally, the head of the cock bird cannot be too small in proportion to the body, the top rather wide, with



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DARK BRAHMAS.

a slight falling over the eye, the whole being rather short and arched; the comb should be treble, and lie close along the top of the head, not peaked behind, as in the Hamburg; the deaf ears should fall below the wattles; the neck should be fairly long, and distinctly arched, and the hackle should sweep down from the head, and flow well over the back and shoulders; the back should be wide, and flat across, but very short, the saddle appearing to take its rise almost from the base of the neck; the saddle-feathers should be long and abundant, so as to flow well over the points of the wings; the breast of the cock should be full, deep, broad, and rather projecting, the breast-bone being well set down between the thighs; the shoulders should be rather prominent. The vulture hock is a defect in this breed, as with the Cochin, though the hock should be well covered, and provided these feathers are not hard, and form a sort of spur, there is nothing objectionable.

Through the kindness of Mr. J. E. Pemell, a very successful New South Wales breeder of Brahmas, I am able to give a very accurate illustration of two of his birds of the dark variety. It will be seen that they are not in the best of condition, which is easily accounted for by the season, but the Departmental artist, Mr. E. M. Grosse, has given the birds as he saw them, and any fancier will be able to judge for himself what the birds would look like in the early spring. The male bird is still a cockerel, and won the 1st prize in the cockerel class at the last Sydney show; the hen, also, is a 1st-prize winner of some note.

On the question of utility, the weights I have already mentioned, and which are often exceeded, stamp the Brahma as a good table-bird, and it is a far better layer than the Cochin. It is also a more active, and, I think, a hardier bird. I am of opinion that it will live and thrive in any part of the Colony with fair attention, and, provided it has shade in the warmer, and dry quarters in the colder and damper districts. At the same time, I do not consider it a farmers' fowl, and should only recommend it wherever feather-legged birds are preferred by the person desiring to keep a few to supply the family with table-birds and eggs on a small scale. They should never be allowed to roost on perches; a good wide flat board, with a light straw litter, is the proper thing, and this may be made so as to cover the nesting-boxes. They are certainly handsome birds, whether light or dark, and breeding them with a view to exhibition will be found a most interesting hobby.

I append Lewis Wright's "Schedule for judging Brahma":—

General Characteristics of Cock.

Head and Neck.—General appearance of head very short, small, and intelligent; beak short, curved and stout at the base; comb triple or in three ridges, resembling three small combs, the centre being the highest, and the whole small, low, and firm on the head, the centre ridge *perfectly* straight and neatly serrated; wattles moderately long, thin, and pendant; deaf-ears large, and hanging below the wattles; neck well proportioned and finely curved, as in a spirited horse, and very thickly furnished with long hackle, which should flow well over the back and shoulders.

Body.—General shape large and deep, but tight and compact in make; back broad and short; saddle very broad and large, with a gradual and decided rise to the tail, so as to form no angle with that member; wings larger than in Cochins, but still small and neatly tucked up, with secondaries carried well under the primaries; breast full, prominent, and reaching well down.

Legs and Feet.—Thighs large and well furnished with fluffy feathers, the hocks being entirely covered with soft curling feathers, but free from stiff quills (vulture hock) which are particularly objectionable; shanks rather, but not too short, thick, wide apart, and

heavily feathered down the outside, the feathering to start out well from the hock, and continue to ends of outer and middle toes; toes large, straight, and well spread out.

Tail.—Much larger than in Cochins, but still small, carried nearly but not quite upright, and the top pair of feathers curving outwards as in the tail of the black cock; sickles very short, and not curving much downwards, but lesser sickles and tail coverts very abundant, covering nearly the whole side of the tail.

Size.—Very large, ranging from 11 lb. to 15 lb. in cocks, and 8 lb. to 11 lb. in cockerels.

General appearance.—Very symmetrical and compact.

Carriage.—Noble and commanding, with the head carried very high.

General Characteristics of Hen.

Head and Neck.—General appearance of head very small, peculiarly arch and intelligent, caused by a slight fulness over the eye, which should on no account tend to coarseness; beak and head rather short, as in the cock; comb as small as possible, a large loose comb being particularly objectionable; deaf-ears well developed; wattles nicely rounded, neat, and free from any folds; neck short, very full in hackle, and free from twist in the hackle.

Body.—General shape square and neat; back wide, flat across, and short; cushion broad and large, not convex or globular as in Cochins, but rising to the tail; wings moderate in size, and well tucked into the fluff and cushion-feathering; breast very prominent, low down, and full.

Legs and Feet.—As in cock, but as short as possible.

Tail.—Rather short, so as not to rise much above the extremity of the cushion, and carried nearly upright.

Size.—Very large, ranging from 8 lb. to 13 lb. in hens, and 6 lb. to 9 lb. in pullets.

General appearance.—Massive and square, but neat and compact.

Carriage.—Matronly and dignified, both head and tail being well carried up.

Colour of Dark Brahmas.

In both Sexes.—Beak yellow, yellow with a dark stripe, horn colour, or black; eyes pearl or red, the latter preferable; comb, face, deaf-ears, and wattles a brilliant red, as little obscured by feathers as possible, the beard or feathers under the throat not to exceed moderation.

Colour of Cock.—Head silvery white; hackle white, heavily and sharply striped with rich black, as free from white streak in centre as possible; saddle feathers the same; back and shoulders silvery white, except between the shoulders, where the feathers should be black laced with white; upper wing-butts black; bow, silvery white; bar, or coverts, glossy black shot with green; secondaries white on outside web, which is all that appears when wing is closed; black on inside; the end of every feather black; primaries black except a narrow white edge on outside web; breast, under-parts and leg-feathers glossy black, as intense as possible, or black evenly and sharply mottled with small spots of white; fluff black, or black laced or tipped with white; (all black in the under-parts preferable for exhibition); tail black, richly "shot" or glossed with colour, white not a disqualification, but very objectionable; shanks a deep orange-yellow.

Colour of Hen.—Head and hackle, silvery white, heavily and sharply striped with black, the marking to extend well over the head; tail black, the top pair edged with grey; rest of the plumage a silver-grey, dull-grey, or steel-grey grained-colour, accurately pencilled over in crescentic form with steel-grey, blackish-grey, or black; the breast to be perfectly marked, and free from streaks up to the throat; a chestnut tinge not objectionable, if of a rich and not dingy character; the leg-feathers to be pencilled as the body; shanks a deep yellow, with or without a dusky tinge.

VALUE OF DEFECTS IN JUDGING.

Standard of Perfection.

A bird ideally perfect in shape, size, colour, head and comb, cushion or saddle, leg-feathers, tail, &c., and in perfect health and condition, to count in points ...	100
If of extraordinary size, add on that account	5

Defects to be deducted.

Bad head and comb (comb to count 7 in cocks and 5 in hens, ...	12
Scanty hackle	5
Want of cushion	7
Want of fluff	6
Want of leg-feather	15
Vulture hocks	5
Bad shape or carriage of tail	6
White in tail	10
Primaries out of order*	15
Pale legs	8
Curved toes	10
Stain of white in deaf-ear	5
Splashed or streaky breasts in dark, or black specks in light	15
Shank-feather (in dark hens) not pencilled as the body	4
Other faults of colour	10
Want of size	20
,, general symmetry	15
,, condition	12
,, ,, (if total)	35

* This refers to primaries merely "slipped" outside the wing. For primaries actually twisted on their axes, see list of disqualifications below.

Disqualifications.—Birds not tolerably matched; primary feathers twisted on their axes; utter absence of leg-feather; pinky legs; large red or white splashes in dark birds, or conspicuous black spots in light; round or crooked backs; wry tails, crooked bills, knock-knees, or any other bodily deformity; any fraudulent dyeing, dressing, or trimming.

Silk Growing.

In consideration of the difficult tasks often undertaken by novices in silk culture, and in sympathy with their want of knowledge and experience, to meet inquiries the following suggestions and notes for their assistance are submitted:—

In the very first place it is most desirable, rather than discuss the "rearing of silkworms" (which is in any case premature at this moment), to point out, first, to seekers for information, the far greater importance of "growing plenty of mulberry" to supply the large quantities of leaf that will assuredly be in demand, whether for the rearer's own use or for sale to others, who, if food leaf should be available, would buy the leaf and raise the silkworms. This demand for leaf is quite as certain to happen as that wheat grown in a new quarter is sure of finding a mill to grind it.

The kinds of mulberry best to grow in any particular locality can only be learned by reference to competent authority. As the Government has already determined and proclaimed that the growing of silk is a "public purpose" within the meaning of the Land Act of 1884, and has appointed a superior officer to attend specially to inquirers, owners of land, farmers, and others generally, should communicate in writing with the Department of Agriculture, in Macquarie-street, stating their desires and intentions, the character and extent of ground, their purpose to devote to the growth of the mulberry so much land and so much money if necessary, climate, locality and aspect, soil, if fenced, &c., which would receive due attention.

Probably this line of action would materially lessen people's labours and mistakes, as well as contribute to their success.

While the mulberry trees are growing, persons of both sexes seeking the addition of a merchantable and profitable fresh source of gain from their land should obtain practical instruction and experience in the pruning and general management of mulberry trees while the trees are yet young, as well as their treatment afterwards, besides learning proper and economical methods of rearing worms from the egg (or after hatching if supplied with young live worms) through the various stages of caterpillar while feeding, and during their moults, &c., to the cocoon, moth, and egg again.

Much that would be instructive and useful to any inquirer may be learned by carefully reading the Report on Silk Culture by Walter Scott Campbell, Esq., F.L.S., published by the Government.

Every idea or project should be discarded and discouraged of beginning silk growing or even a mulberry plantation on any smaller scale than would be fully adequate to yield a sensible beneficial monetary return. It is time effort should be avoided which would necessarily be abortive and unproductive, and discredit the industry, as has so often been the case already. It is manifest that to grow a single potato, or a single plant of corn, or of any vegetable or fruit as an experiment, is only trouble without profit, beyond the mere pleasure of seeing them grow.

Hence it may be useful to mention :—

That the "unit" by which silkworm rearing is reckoned means one ounce of 437½ grains, avoirdupois the "heavy pound" of 7,000 grains = 16 ounces.

An "ounce of eggs" (known technically as "graine" or "seed") means from about 38,000 (perhaps fewer) or 40,000 to about 52,000 or 54,000 eggs, according to breed, race, and quality, 40,000 being usually regarded as one ounce.

Two ounces of eggs, say about 80,000, is by all experience fully enough for any one rearing, in any one place, at one time, and such a rearing should only be attempted by a competent rearer, where there is abundance of leaf ready grown and close at hand, to be gathered as needed.

Crowding or having excessive numbers near together occasions more or less weakness and sickness, and is a sure cause of losses in several ways, and often of disease. In any management worthy the name each and every worm must have its abundant supply of fresh air, both for its own comfort and its own health, as well as of the whole rearing, by the removal and dissipation of the vapours continually thrown off.

Whatever the number of worms, all of one rearing should each and every one be of exactly the same age, hatched out on one (the same) day, go through all their stages contemporaneously, each one neither sooner nor later than its fellows, and become cocoons, moths, and eggs again—in each and in every stage the same days.

To effect this demands good management, skill, and care, which can only be learned by practical experience.

The more or less perfect, intelligent, and masterful, the experience truly acquired, so will be the economy and profit of the rearing. The more it comes short of good management the greater the confusion and waste, labour, trouble, and expense, with proportionate less results in silk and in money.

A plantation should be from 5 upwards to about 20 acres or more, and all of one kind of mulberry, ninety trees would be enough on one acre of first-quality, deep, rich, land well drained and favoured with a good regular rainfall, and 120 to 150 trees on fairly-good land.

The value yearly of mulberry leaf is hard to state with any degree of accuracy. The quality, from obviously varying considerations, must vary greatly, and quantity likewise. It may be sufficient to say that the quantity of leaf from an acre well grown is very considerable, if sold at 10d. or 1s. per cwt. it is reckoned to yield about £3 or £4 to £7 or £8 more or less, as may be, per acre, that is, if sold by the grower of the leaf and paid for by the raiser of cocoons.

The results of cocoons.—From actual local experience the produce of an acre of mulberry properly cultivated and planted, properly pruned and tended, should yield, with fair management, £15 to £25 per acre yearly, after a sufficient growth of the trees.

It might be mentioned in a casual way that owners of land, with sons and daughters especially, could with very slight outlay provide for each one severally by making plantations, even while they, the girls and boys, are growing up and the plantations at the same time also growing, and thus draw profit from their land additional to what it yields now—if indeed it yields anything at present. It should be noted that returns from silk-growing are less subject to fluctuation in demand, and less liable to disappointment from climatic causes than fruit or any agricultural produce now raised

in the Colony, not even excepting tobacco or grapes. Men and women would thus benefit themselves, greatly improve their properties, obtain a new crop for cash sale, endow a family with opportunity and means for employment which would exercise their thinking and administrative faculties, give them healthy attractive work on their own domains. Incidentally at the same time, by force of example, they would further fresh settlements and occupation of more land, and bring population to a neighbourhood where the industry may have been started.

The co-operative system, by which a grower of leaf and a labourer rearing worms for cocoons bargain to share results on terms agreed upon, is much in vogue in very many places. Often the party who grows the leaf also supplies the eggs (or better still, worms just hatched, or about to hatch) to be reared by a second party—a great mutual help to both parties, who must have confidence in each other. In Italy, where this method largely prevails, the whole of the cocoons as soon as completed are taken to the local "market," weighed by the "public weigher," and sold at the open market-rate, or by previous contract to some dealer at a fixed price, or more generally to a "filanda" or "reeling mill" for ready money.

In regard to silk-growing it may be remarked that in case of the proprietor of the trees raising his own cocoons by means chiefly or wholly by his or her own personal labour, or with assistance of the handiwork of members of the family, the whole or nearly the whole of the produce is profit, and profit without interfering with the growth of, or attention to, any other crop. The cash is certain and immediate, earned more quickly, generally with fewer disappointments, and realizable more readily than any other agricultural crop.

Some cocoons reared in Sydney, November, 1893, on inferior mulberry leaf (unpruned *multicaulis*):—"Empties," without floss or other matter, weighed net about 4 grains each cocoon. Sample cocoons arrived with graine, December, 1893, the gift of Signor A. Martelli, reared in Italy:—

8 cocoons, empties, with a little floss, weighed gross, including attached thread and label—variety, Bianco Indigeno, 26·6 grains.

10 cocoons, with less floss, weighed gross, including attached thread and label—variety, Gransasso, 58·8 grains.

11 cocoons, with some floss, weighed gross, including attached thread and label—variety, Fossombrone, 65·5 grains.

15 cocoons, with some floss, weighed gross, including attached thread and label—variety, Novi Ligure, 84·5 grains.

19 cocoons, clean and little floss, weighed gross, including attached thread and label—variety, Giallo Indigeno, 92·6 grains.

Average, 5·2 grains.

A lot of 8 cocoons reared in the County of Cumberland, by Signora Belotti, November, 1893:—Empties clean and good, with floss as taken from the bush, with husk, &c., inside, averaged 6·74 grains.

The results thus shown are well up towards the standard gained for many years by Mr. Brady at Curl Curl and at Antony with different varieties of silkworms. They also correspond very fairly with the experiences of Mr. James Fry, Mr. George Thorne, Mrs. Hobbes, Miss Thorne, and Miss Ottmann, all in this Colony.

There can be no doubt that, with proper food and fair management, New South Wales may obtain and hold a foremost place in the production of silk in open competition with any part of the world, and certainly with results much better than now obtained in "cheap labour" countries.

The *Mark Lane Express* (London, 11th December, 1893) from its Paris correspondent says:—

"Owing to the favourable temperature of the spring (in France), and the care exercised in the selection of eggs, the results of the silkworm season have been very satisfactory. There were this year (1893) 148,971 breeders, against 141,487 in 1892, and these have hatched 225,012 ounces eggs, against 227,156 the preceding year. The production of new cocoons has been correspondingly larger, and prices have risen, not only for cocoons for weaving but for breeding."

The intention of the Government is that persons who earnestly desire instruction in silk-growing should, as far as practicable, have the opportunity of obtaining it from their appointed officer; and as this opportunity must necessarily be very limited at first, it is obvious that the demands for such instruction from persons possessing or actually forming plantations would have to be preferential.

Practical Vegetable Growing.

Directions for the Month of March.

During this month the heat of the sun is likely to diminish considerably, and some of the worst of the summer weeds lose vigour and become less troublesome. All rubbish, such as old useless vegetables, weeds, &c., should be cleaned up and either burnt or kept in a rubbish heap to rot and become useful manure. Whenever an opportunity presents itself, preparation should be made for new crops, and new ground can be put in order. It should be well and deeply dug and above all things well drained. If not sufficiently rich some cattle, sheep, or horse droppings should be well mixed with the soil as it is being dug up. This manure would be improved by being well rotted before it is used, one good reason being that most of the weed seeds that are almost certain to be in the dung will probably be destroyed. The rotting of the manure had better be done under some shelter, out of the rain, so that the best part of the manure cannot be washed away.

The latter part of the month of March is about the best time of the year to strike cuttings of ornamental flowering plants, such as roses, fuchsias, and others.

Asparagus.—It would be advisable to get a bed ready for some plants as soon as this can be done. The ground should be trenched 18 inches or 2 feet deep, some manure being well mixed up with the surface soil as it is being dug. It is not necessary to make a very large bed, for a few plants even will give an occasional dish, if the plants are looked after, and if the soil happens naturally to suit them the supply will be considerable. When the ground has been dug up the surface should be left as rough as possible until the time comes for planting in the very early spring. Asparagus likes a rich sandy deep soil, but it will grow fairly well in almost any kind of soil that has been well prepared. It is a native of the sea coast of Europe, and has been in cultivation from remote times and long before the Christian era. It is found growing wild in the sandy interior of Russia, far away from the sea coast, but probably the soil is saline. It should grow well in the inland parts of this Colony where the saltbush grows, and it will probably succeed splendidly where it could be irrigated by the water from artesian bores. At the present time nothing need be done beyond preparing the ground.

Bean, French or Kidney.—In the warm districts of the Colony a few rows should be sown, if the soil is not very dry. It will probably be too late to sow in the cold districts, for the plant cannot stand frost. Plants that have ceased to bear should be pulled up to make room for some other kind of vegetable. Old withered plants of beans or peas when allowed to remain give the vegetable garden a most miserable neglected appearance, besides taking up space that might be producing something useful. Every grower

of vegetables should strive to keep his garden tidy and make it worth looking at. If this be done the place will become more and more interesting and profitable.

Bean, Broad.—This vegetable has been in cultivation from the most remote times—thousands of years before the Christian era. The soil best suited to it is a heavy clay loam, although it will grow and bear well in almost any kind of soil. It would not be advisable to sow to any great extent during the present month. Dig the ground well, and if it is poor apply plenty of horse or cow dung, and if this has been well rotted, all the better. If artificial manure is used, apply little or no sulphate of ammonia or nitrate of soda. Use bone dust or superphosphate of lime and potash. Sow in rows from 2 feet to 3 feet apart, according to the variety, for the dwarf-growing kinds may be sown closer together than the tall. The seed should be sown about 4 or 5 inches apart in the rows.

Beet, Red.—Sow a row or two of this useful vegetable. Thin out well any plants that are coming up from previous sowings.

Beet, Silver.—Sow a little seed in ground that has been well manured, that is, if the soil is not naturally sufficiently rich without it.

Borecole or Kale.—It is doubtful whether this vegetable is worth troubling about when there are so many other kinds of the cabbage family can so easily be grown in the Colony. It will succeed best in the coolest districts. Seed may be sown in beds or boxes like cabbage, and the seedlings afterwards transplanted. It prefers a rather stiff soil, but may be grown successfully in almost any garden.

Broccoli.—Seed may be sown in the same way as cabbage seed, and the seedlings afterwards transplanted, bearing in mind the rule that the richer the soil the wider apart to plant. Plants available from previous sowing may be planted out.

Cabbage, *Brussels Sprouts*, *Cauliflower*, and *Savoy* may be planted out if well-grown seedlings are available. Seed also may be sown, and care should be taken not to sow it too thick in the drills.

Celery.—Sow a pinch or so of seed in order to have plants available when required. It should be remembered that celery requires a great deal of moisture during its growth, for its native localities are wet and marshy places. Plant out a few well-grown seedlings in well-manured ground. Make shallow trenches so that water and liquid manure when applied will not run to waste. It may be mentioned that although the plant requires plenty of water during its growth, it may be possible to over-water, whereby the result is a loss of flavour. The proper quantity to apply can only be learned by experience, and anyone who will take an interest in the gardening work will soon learn. The best manure to use for celery is the droppings of farm animals, mixed well with the soil when the ground is being prepared. If anyone wishes to try the common old method of growing and blanching this plant he should dig out trenches 12 inches deep or more and about 16 inches wide, the soil taken out of the trench to be spread along the top of the bank. At the bottom of the trench dig in a good supply of manure and plant strong stocky young seedlings 9 inches apart in the middle of the trench. The seedlings should be moved from the seed bed with care, and the roots injured as little as can be avoided. When the plants have attained a good growth they can be earthed up so as to make the stalks white, or "blanched" is the ordinary term used. The soil must not be allowed to drop into the centre of the leaves, or they will probably decay or become

injured and unfit for use. Some gardeners use paper round the stalks; but this is unnecessary if the stalks are held together, and care is taken when earthing-up is done.

Cress and Mustard.—Sow a little seed every now and then in a small, well-manured piece of ground. The plants will need water frequently when they come up, and subsequently.

Endive.—Seed may be sown in a seed bed or in boxes, and when the seedlings have grown large enough to handle they may be transplanted. This plant is best suited to a warm climate. Plant out about one foot or fifteen inches apart. When the plants are pretty well full grown the leaves should be tied together so that the inner ones may become white and tender.

Herbs.—Seeds of all kinds may be sown. These useful plants should not be forgotten. Sow in pots, boxes, or seed-beds and afterwards transplant. Parsley should be transplanted whilst it is very young, for it soon sends out a long tap-root, which had better not be broken.

Lettuce.—Sow seed in the seed-bed for future planting out. If any strong young lettuces are to be had plant them out in rich, well-dug ground. It is very often the custom to sow lettuce seed, at this season of the year, in rows where the plants are to grow, and not transplant, because the lettuces are very likely to run quickly to seed.

Leek.—This time of year is about the best season to sow seed largely of leeks. Prepare a seed-bed and sow in rows. When the plants are about 6 or 8 inches in height they may be transplanted to a bed made exceedingly rich with good farm-yard manure. Make shallow trenches and plant in rows about 18 inches apart, the leeks to stand about 9 inches from each other. Water and liquid manure will be needed often if it is desired to grow the best of plants.

Peas.—In cool, moist climates sow a few rows of this excellent vegetable. Prepare the ground well, and, if it is poor, apply a good deal of farm-yard manure.

Radish.—Sow a little seed occasionally to keep up a supply.

Sea Kale.—Sow a little seed in a seed-bed and afterwards transplant the seedlings, just as cabbages are planted, to well-manured, deeply-prepared ground; when the plants attain a good size they need to be covered and blanched, and for this purpose special kinds of pots are made, but dead leaves, manures with plenty of straw, boxes, or something to keep the light away from the plants, will answer.

Spinach.—Sow seed in drills in rich, rather moist, but well drained soil. Let the drills be about 18 inches apart, and when the seedlings appear, thin them out well. This is a very good vegetable and well worth growing.

Shallots and Garlic.—Plant out in drills about one foot apart as much of this useful vegetable as is likely to be required. The bulbs or cloves can be purchased from any seedsman. Dig the ground deep and manure it well. When planting just press the bulb firmly into the soil. Keep the plants free from weeds as they grow. *Garlic* may be planted out in the same way as the above, taking care to divide the bulbs.

NOTE.—The month of March is probably the best time of year to strike cuttings of plants for the flower garden. The ripe well-matured cuttings of roses will strike readily. This is a good time to sow seeds of annuals, which if raised now and planted out before the winter will flower very early in the spring.

Orchard Notes for March.

The notes which appeared in the last number of the *Gazette* for the month of February are generally applicable to March as well, especially as regards the care to be taken with the gathering, grading, packing, and marketing of the fruit, as the disposing of the fruit will constitute a large portion of the orchard work for the month. The bulk of the fruit to be marketed will consist of apples, pears, late peaches and plums, and passion-fruit. During the month the most of the later varieties of apples will be gathered in the coast district, and as they are not, as a rule, as good keepers as the same varieties grown in the colder parts of the Colony, they should be sold when gathered, being, however, allowed to thoroughly ripen on the trees. During this present season a large quantity of very unripe fruit—totally unfit for selling—has been sent to the Sydney markets, and, at the same time, there has been a large quantity of over-ripe fruit, which is often almost as worthless, as it will not stand handling. Until our fruit-growers learn what to pick, and how to pack it, and thoroughly realise the immense importance of sending their fruit to market in such a manner as to arrive in the best condition, and when opened to show to the best advantage, it will be impossible to obtain satisfactory prices; and it is very unfair for them to throw the whole blame of the unsatisfactory prices on the commission merchants when the fruit-growers are often the ones to be most blamed. Even in a glutted market, good fruit, arriving in good condition, has been fetching very satisfactory prices, whereas rubbish has been hard to get rid of at any price.

In the colder districts many of the mid-season apples and pears will be gathered, but it is not advisable to gather the late varieties for storing till they are thoroughly developed, as if gathered when immature they will shrivel with keeping, and will not develop their full flavour. With pears, however, this does not hold good, as no pear should be allowed to ripen on the tree. The exact state at which pears should be gathered varies with different varieties, but, generally speaking, it is when the pear is fully developed—has lost its woody taste—and has developed sufficient sugar to perfect its ripening when gathered. The exact state can only be learnt by actual experience, on account of the variation in the ripening of different varieties.

The codling moth will still require looking after, and the bands should be removed at least twice during the month, and the worms destroyed. After this month, however, it is not likely that any moths will hatch out for the season, so that the bands can be left on the trees till all the fruit has been gathered, when, being no more required for the season, they should be taken off and destroyed.

Keep the orchard clean during the month by the use of the cultivator. No one can afford to grow weeds in an orchard, as, besides forming a harbour for all kinds of insect and fungus pests, they are depriving the soil of the food required by the trees, and in a dry time every weed is a pump taking water out of the soil, which is often badly wanted by the tree itself, especially in badly-cultivated and undrained land.

General Notes.

The Disc Churn.

The remarkable results reported in English agricultural papers achieved by means of the "New Era" disc churn have been fully sustained at a trial which was held under the auspices of the Department of Agriculture on the 11th instant. Probably the most remarkable characteristic of this churn is the simplicity of its construction. It consists of a flat-sided box with a circular bottom. A multiplying gear is fitted outside the box, which works at great speed the only inside fitting—a plain wooden disc. The only covering is a narrow lid with rather deep projecting sides just covering the disc as with a hood, and there being openings in either side of this cover the entire process can be watched by the person working the churn. The cream, being of a sticky nature, adheres to the disc, which being revolved at great speed dashes the cream into the hood and against the sides of the churn. This perfectly aërates the cream, and the churn being open at the top all bad gases escape at once instead of being re-churned into the butter. When the cream gets quite thick and the butter globules are almost ready to break, a little water is added by means of a syringe, which washes out the corners and sides of the churn, so that the whole of the cream comes into the churning operation. When the butter breaks, more cold water is added, and a few turns of the handle are given. The buttermilk is turned off by simply removing a wooden plug from the lowest point of one side of the churn, the plug being then replaced and the churn filled with cold water, according to the judgment of the operator. About two minutes' fast churning in both directions is given; the water is then thrown off, and the butter is then ready for brining, which is accomplished in the same manner as the washing. The hood is then removed and swilled out with cold water, the churn is filled up with cold water, which is then drawn off, and the butter is removed with a scoop. Then follows one of the most interesting portions of the operation:—The butter which was removed from the churn is placed in a utensil called a dryer. This consists of a drum with perforated zinc sides lined with butter-cloth and wooden top and bottom, one removable. This drum fits on to the axle from which the disc is removed, and is whirled rapidly by means of the same gear until moisture ceases to fly off. The dryer is then removed from the churn, and the butter, with the grains intact, is ready to be made into pats for sale without any further working.

On the occasion above referred to two trials were made in the presence of Mr. W. S. Campbell and several officers of the Department of Agriculture, Mr. Angus Mackay, of the Technical Education Branch, and several Press representatives. The site of the operations was in the rear of the

offices of the Department of Agriculture in Macquarie-street, the churn being fitted up under a corrugated-iron shed, where the temperature ranged from 87 to 92 degrees (F.) Two tests were carried out. The first was with 8 quarts of cream (the quantity for which the churn used was intended), at a temperature of 72 degrees. The butter came in 2½ minutes. This was not put into the dryer, owing to its being somewhat overchurned. In the second test nearly 10 quarts of cream were used. This was put in the churn at a temperature of 55 degrees, and the butter, which was rather longer in coming, came at 66 degrees. It was a mass of golden globules, and broke with a perfect grain. On being removed from the churn it was placed in the dryer, and within 15 minutes was turned with texture and grain unimpaired and ready to be made into pats for sale. It is not considered necessary to expatiate upon these facts, which speak for themselves; and Messrs. Lassetter & Co. are to be congratulated on their promptness to secure the Australian agency for this valuable improvement in butter-making appliances.

A Simple and Efficacious Codling-moth Trap.

At a recent meeting of the Pomological Committee of the Department of Agriculture a very simple and efficacious codling-moth trap was submitted by Mr. Morgan, of Goulburn, one of the members of the Committee, and was very favourably commented upon. The trap consists of two pieces of ¾-inch deal, about 4 inches broad and 16 to 18 inches long, hinged together at one end with a strip of zinc, so as to allow the two pieces to be folded together or opened easily. A piece of thick brown paper is placed between the two pieces of board, which are then tied together by a piece of string at the unhinged ends. The trap is now ready for use, and is stood at the foot of the tree, care being taken that all other shelter in the shape of loose bark, &c., is first carefully removed, when all the larvæ of the moth, when fully developed and looking for a place in which to pupate, will take refuge between the boards of the trap, and they may then be easily destroyed. From one of the traps exhibited Mr. Morgan has taken this season as many as eighty larvæ of the moth in three days, and when opened before the meeting the two traps must have contained fully 100 fully-developed larvæ. An improvement in the trap was suggested by replacing the zinc hinges by leather ones. The easiest way to destroy the larvæ caught in the traps is to place the traps bodily in boiling water. The larvæ should not be crushed and allowed to remain in the trap, as, if so, the traps will become surfeited with small ants, which will prevent any more larvæ from taking shelter in the trap. The traps should be examined every three to five days.

The Tobacco Trade.

In view of the recommendations by Departmental experts that New South Wales tobacco-growers should look to the European markets, the annexed table of current prices in London is extracted from the *Tobacco Trade Review*, of 1st November, 1893. This, of course, shows the trade actually done, and may therefore be taken as a fair indication of what growers may expect to realise for suitable leaf, freight, &c., being duly allowed for.

PRICE CURRENT.

London, 31 October, 1893.

THE following prices are quoted subject to duty, and are from the latest actual market sales :—

	Prices this day.			Prices at the same period of 1892.		
	s. d.		s. d.	s. d.		s. d.
Virginia leaf, ordinary and faded ...						
part dark and sweet...						
fine dark and sweet ...						
ordinary sound ...	0 6	to	1 3	0 4	to	1 2
middling						
fine and spinning ...						
fine bright	0 10	,,	1 3	0 8½	,,	1 4
Virginia stemmed, ordinary faded ...						
common (short)..	0 6	,,	0 10	0 6	,,	0 10
middling ...						
fine	0 11	,,	1 1	1 0	,,	1 4
Western leaf, ordinary	0 4	,,	0 7	0 4	,,	0 7
middling						
fine	0 7½	,,	0 10	0 7½	,,	0 10
Western stemmed, common	0 4½	,,	0 8	0 5	,,	0 8
middling... ...						
fine	0 8	,,	0 10	0 9	,,	0 10
Ohio leaf, scrubs	0 4	,,	0 7½	0 5	,,	0 7½
leafy brown	0 8	,,	0 10	0 8	,,	0 10
coloury and leafy...	0 10	,,	0 11	0 10	,,	0 11
yellow	0 11½	,,	1 1	0 11½	,,	1 1
Columbian and Ambalema	0 2	,,	2 0	0 2	,,	2 0
Dutch and German	0 4	,,	1 4	0 4	,,	1 4
Esmeralda	0 10	,,	1 6	0 10	,,	2 0
Sumatra	1 0	,,	6 6	1 0	,,	4 0
Turkey	0 5	,,	0 9	0 5	,,	0 9
Greek	0 3	,,	0 5	0 3	,,	0 5
Negrohead and Cavendish	0 7½	,,	1 4	0 7½	,,	1 4
Havana...	1 4	,,	3 0	1 4	,,	0 0
Cuba and Yara...	1 0	,,	2 0	1 0	,,	2 0
Algerian	0 0	,,	0 0	0 0	,,	0 0
Java	0 5	,,	0 9	0 5	,,	0 8
China	0 3½	,,	0 7	0 4	,,	0 6½
Japan	0 6	,,	0 8½	0 5	,,	0 6
Japan Cigar	0 5	,,	0 6	0 6½	,,	0 10
Seed leaf	0 4	,,	1 1	0 4	,,	1 1
Manilla leaf	0 9	,,	3 0	0 9	,,	3 0
Mexican	0 7	,,	5 0	0 7	,,	5 0
Paraguay	0 3	,,	0 0	0 3	,,	0 0
Stalks, duty paid	0 0	,,	0 0	0 0	,,	0 0
Smalls	0 0	,,	0 0	0 0	,,	0 0
Havana Cigars	8 0	,,	40 0	8 0	,,	40 0
Manilla Cigars and Cheroots	4 0	,,	6 6	4 0	,,	6 6

DUTIES.

Tobacco Manufactured, viz. :—

Cigars	the lb. 5s.
Cigarettes	the lb. 4s.
Cavendish or negrohead	the lb. 4s. 6d.
Cavendish or negrohead manufactured in bond	the lb. 4s.
Other manufactured tobacco	the lb. 4s.
Snuff containing more than 13 lb. of moisture in every 100 lb. weight thereof	the lb. 3s. 9d.
Snuff not containing more than 13 lb. of moisture in every 100 lb. weight thereof	the lb. 4s. 6d.

Tobacco Unmanufactured, viz. :—	
Containing 10 lb. or more of moisture in every 100 lb. weight thereof	the lb. 3s. 2d.
Containing less than 10 lb. of moisture in every 100 lb. weight thereof	the lb. 3s. 6d.

The American tobaccoes are those which commence the list, as far down as "Ohio leaf, yellow," the range being from dark to bright. White Burley and Yellow Prior, seeds of which have been distributed by the Department, are the sorts from which "bright" tobaccoes are hoped to be derived. While on the subject of prices it is interesting to note that 7½d. per lb. has recently been obtained in Sydney for Tumut leaf, which is not actually superior to the ordinary bulk of Tumut tobacco, except as regards sorting and preparation for market.

AGRICULTURAL SOCIETIES SHOWS, 1894.

Society.	Secretary.	Date.
Wollongong Agricultural Society	J. A. Beatson ...	Jan. 31, Feb. 1.
Berry A. and H. Society	A. J. Colley ...	Feb. 6, 7, 8.
Gosford A. H. and I. Association...	H. S. Berenge ...	,, 9, 10.
Luddenham A. and H. Association	K. Campbell ...	,, 13, 14.
Manning River (Taree) A. and H. Association ...	W. Plummer ...	,, 14, 15.
Shoalhaven A. and H. Association	R. Leeming ...	,, 15, 16.
Lithgow A. H. and P. Society	Dr. M. Asher ...	,, 15, 16.
Tumut A. and P. Association	W. H. Bridle ...	,, 27, 28.
Marulan P. A. H. and I. Society	H. Morico ...	,, 23.
Kangaroo Valley A. and H. Society	H. Joyce	,, 25, 26.
Candelo Agricultural Association	C. H. Brooks ...	,, 27, 28.
Tenterfield P. and A. Society	J. Harker ...	,, 27, 28, Mar. 1.
Port Macquarie Agricultural Society	A. E. Pountner ...	,, 28, Mar. 1.
Lismore Agricultural Society	C. S. Connor ...	,, 28, Mar. 1, 2.
Berrima District (Moss Vale) A. H. and I. Society	James Yeo ...	Mar. 1, 2, 3.
Nepean District A. H. and I. Society	A. Baker	,, 1, 2, 3.
Bega A. P. and H. Society...	A. P. Wilson ...	,, 7, 8.
Upper Murray and Tumberumba P. and A. Association	W. Willans ...	,, 13, 14.
Armidale (New England) A. and P. Association ...	W. H. Allingham	,, 20, 21, 23.
The Royal Agricultural Society of New South Wales	F. Webster ...	,, 21 to 27.
Castle Hill A. and H. Society	F. H. G. Rogers...	,, 26, 27.
Walcha P. and A. Association	H. Chapman ...	April 4, 5.
Gundagai P. and A. Society	W. E. Kyle ...	,, 5, 6.
Namoi P. A. and H. Association	T. Riddle... ...	,, 11, 12.
Dubbo P. A. and H. Association	G. H. Taylor ...	,, 24, 25, 26.
Warialda P. and A. Association	W. B. Geddes ...	,, 26, 27.
Mudgee Agricultural Society	J. M. Cox ...	,, 26, 27.
Macleay (Kempsey) A. and H. Association ...	H. R. Gray ...	May 9, 10, 11.
Upper Manning (Wingham) A. and H. Society...	P. Doust	,, 16, 17, 18.
Forbes P. A. and H. Association	W. G. Dowling ...	Aug. 9, 10.
Northern (Singleton) Agricultural Association ...	C. Poppenhagen ...	,, 15, 16.

N.B.—Secretaries will greatly oblige by giving the Department early intimation of the dates fixed for Shows.

[2 plates.]

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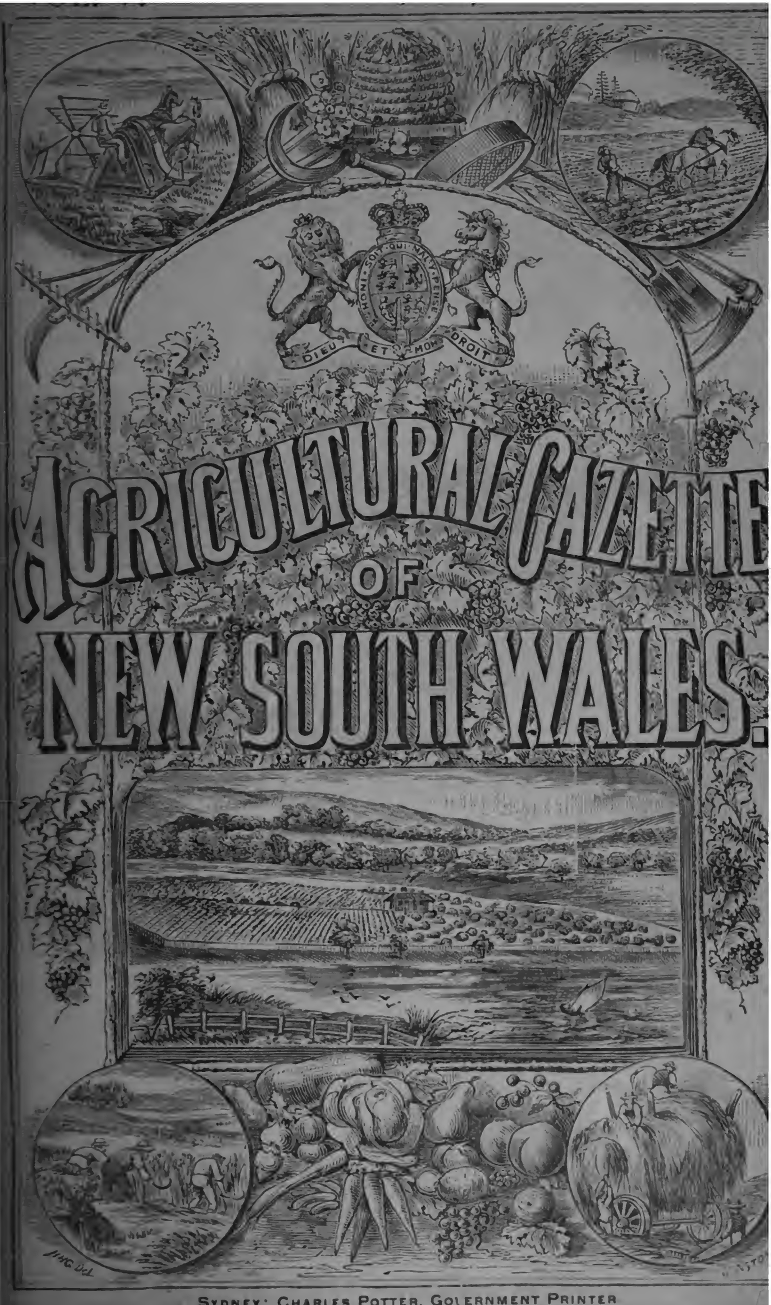

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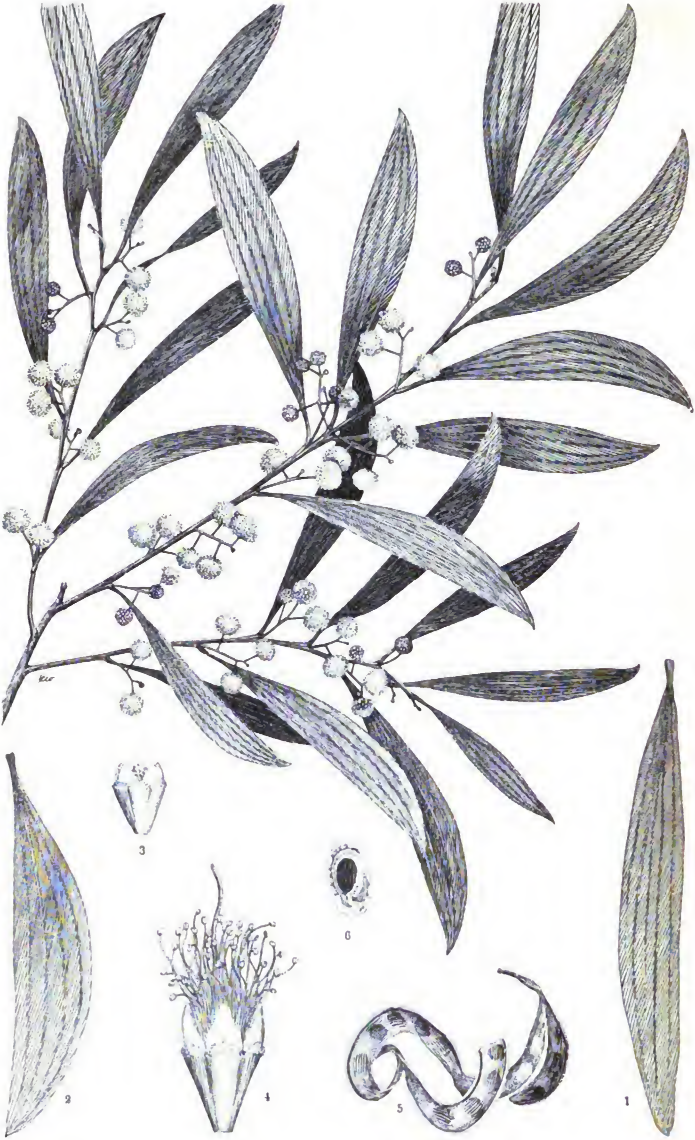

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Acacia melanoxylon, R. Br.

" Blackwood or Mudgerabah."

Useful Australian Plants.

By J. H. MAIDEN,
Consulting Botanist.

No. 7.—The Blackwood or Mudgerabah.

(*Acacia melanoxylon*, R. Br.)

Other Vernacular Names.—It is called "blackwood" on account of the very dark colour of the mature wood. In Captain P. P. King's work, Allan Cunningham refers to it as the "blackhearted wattle" or "native ash." It is also called "lightwood" in Tasmania, Victoria, and southern New South Wales, but the origin of the term, even amongst many people who use it, is not always clear. An explanation often given is that since the great majority of the useful timbers of Australia and Tasmania are heavy, the name is simply to draw attention to its comparative weight. This explanation is, however, untenable. The blackwood has rather a wide sapwood, up to 4 inches, and this is very light in colour—almost white; so that, on removing the bark from a blackwood, a man would at once come across this very light-coloured wood, hence the name "lightwood"; and this is how a good many people explain it. I think, however, the explanation simply is that pale-coloured blackwood is called lightwood. A blackwood which has grown rapidly has often timber paler in colour and more porous than the standard blackwood, and would be called lightwood. Anyhow the fact remains that blackwood and lightwood are absolutely identical from the botanical standpoint, and differ only on account of differences in soil and climate. While on the subject of the pale sapwood, years ago, an old man in the Braidwood district displayed great skill in cutting it into very thin strips, which he used to fashion into baskets of various kinds, and these had a ready sale. The old man's knife was made of hoop-iron, and no one seemed to be able to imitate him in making such excellent basket material. The species has also been sent as "bastard myall" from Port Stephens and Glen Innes, and as hickory from the southern parts of this Colony. It probably bears other local names. North of the Clyde River people are ignorant of the identity of the tree with the blackwood of Tasmania and Victoria, and hence do not employ that term to designate it.

Aboriginal Names.—"Mootchong" of the Ja-jow-er-ong tribe, Victoria, and Mooeyang or Moeyang of the Yarra blacks. "Mudgerabah" is an old aboriginal name in northern New South Wales, and is the name by which the tree is generally known, at the present day, in New England.

Botanical name.—*Acacia*, from *ac*, a point (Celtic), or *akazo*, I sharpen, (Greek), as many of the species are furnished with spines. Spines are, however, the exception in Australian species. *Melanoxylon;* this is from two Greek works signifying "black wood," and Robert Brown, the botanist, who adopted this designation, simply translated the commonly accepted colonial name.

Exudation.—Many of our *Acacias* yield gums, but I have never seen gum on a blackwood, although I have carefully looked for it in different parts of New South Wales and Victoria, and upon trees growing under widely different circumstances.

Bark.—The bark of this valuable timber-tree has usually gone to waste after the wood has been obtained from the logs. Baron Mueller says: "The bark is, however, rich in tannic acid, and ought not to be left unutilized, though no trees of this species should be sacrificed for their bark alone." This may be true as regards Victorian trees, but I have not seen any New South Wales blackwood barks of much value. One from an oldish tree from Monga, near Braidwood, yielded 11·12 per cent. of tannic acid, and 20·63 per cent. of extract. This is the only specimen I have subjected to chemical analysis, but I have roughly tested other barks of the same species, and am inclined to think that blackwood bark is very inferior for the purposes of the tanner.

Timber.—This is considered by some people to be the most valuable of Australian timbers. Perhaps this is a bold claim to make, bearing in mind the high merits of such timbers as ironbark and red cedar, but it is undoubtedly a timber of the highest class, happily combining an ornamental character with great strength. It is hard and close-grained, and is much valued for furniture, billiard-tables, cabinet-work, picture-frames, gun-stocks, walking-sticks, crutches, tool-handles, railway and other carriages, boat-building (stem and stern-posts, ribs, rudder), naves of wheels, parts of organs, pianofortes (sound-boards and actions), and many other purposes too numerous to individualise. Blackwood is strikingly like American walnut in most respects, in fact the former is probably often substituted for the latter without the purchaser being any the wiser, the incentive being that walnut brings about a shilling a foot, and blackwood about a fourth of that price in the Sydney market. If blackwood be treated with lime water or potash, the deception will be complete. Blackwood is pushing itself forward on its own merits, but it has to fight against a good deal of the prejudice which is shown to colonial timbers, largely caused by unseasoned timber having so often been supplied. The similarities of walnut and blackwood are not confined to outward appearance, for their properties appear much the same. Hence a knowledge of the many uses to which the former timber is put is useful as a guide to the capabilities of our blackwood. A good deal of it possesses a "broken grain" and satiny lustre which are exceedingly ornamental. Nothing, in my opinion, resembles the figure of picked samples so strongly as the South African mineral crocidolite, which, as is well known, has a characteristic and beautiful appearance. The figured wood is cut into veneers. It takes a fine polish. It is an excellent wood for bending under steam. It requires fair play in the matter of seasoning, and will well repay any reasonable care expended on it. A drawback to this valuable timber is that it does not take the glue as well as many others. Rosewood behaves similarly to glue; I do not know the reason of this, it may be from the presence of oil-cells. It was largely used for oil-casks, chiefly for the Hobart whaling trade. The lightwood was chiefly used for this purpose. As regards its use for wine-casks, Mr. Thomas Hardy, of Adelaide, has pointed out that this timber is open to the objection that it leaks through the pores when sawn, but it is tight when split on the quarter. As a charcoal wood, its charcoal burns with intense heat, but almost as fast without blowing as it does with, which is of course objected to by blacksmiths. Blackwood is not proof against white ants. Its specific

gravity, according to Baron von Mueller, is from ·664 to ·777, *i.e.*, the weight of a cubic foot of the dry timber varies between 41 and 48 lb. Mr. Gamble gives the weight per cubic foot of an Indian grown specimen at 36 lb., and states that it was cut from a tree twenty years old, and 90 feet high, which gave a plank 2 feet broad; but in India it appears to lack density and deteriorates in value. It is a wood much appreciated by the Victorian blacks. For instance, the Yarra blacks used to make their mulgas or club-shields of it, their throwing sticks (for propelling spears), and their "lil lil," a curved fighting weapon with a knob. Following is a report by Mr. Allen Ransome on some samples of this timber sent from Victoria to the Colonial and Indian Exhibition:—"Samples of both old and young trees were sent for trial. The former were made into joiners' specimens, the latter into casks. The figure of the old-growth wood is very fine, and the surface left by the cutters was all that could be desired. The casks proved a complete success. The wood has already been imported into England in small quantities, and sold at prices from 2s. to 3s. per cubic foot." I quote descriptions of Tasmanian wood by the same authority, as, since we look forward to an increasing trade in colonial timbers with the United Kingdom and the Continent of Europe, a report by a well-known English expert has peculiar value.

"*Blackwood.*—A sound, mild working timber of a brownish colour, closely striped with streaks of various shades of reddish-brown, and frequently crossed by diagonal marks of a light golden colour. The more ornamental logs of this wood are exceedingly beautiful, and should fetch a high price in this (London) market, where they could be used to advantage in place of the best Honduras mahogany, while the less ornamental logs would serve for the higher class of joinery work, such as counter and shop fittings. The younger growth is well suited for cooperage work, and a barrel made from one of the pieces submitted for trial, before being artificially seasoned, is still quite tight, and shows no sign of shrinkage.

"*Lightwood.*—This is an inferior description of blackwood, from which it differs mainly in being of a lighter colour, and having a somewhat more open grain. Although it will not compete with the blackwood for highly ornamental cabinet work, it can be used in the place of cheap mahogany for wardrobe backs and other similar work."

It will be observed that most of the reports on the utility of this timber refer to Tasmanian and Victorian wood. This is because the occurrence of blackwood in New South Wales is known to very few people, whereas, as is stated in the proper place, it is very widely distributed in this Colony, although usually looked upon as some other timber. In sending a New South Wales specimen for identification, Mr. Van Weenen, of Gunnedah, writes to the Department:—"It is only lately that it has been brought to the saw-mills at Boggabri, and the sawyers do not know it. It grows in this district, and is being used by coachmakers and cabinet-makers, who speak very highly of it." Neither do the saw-millers in the Richmond River district know anything about it. There it is chiefly cedar, pine, hardwood, the changes being rung on these three indefinitely. Beyond these, little is locally known of colonial timbers. Strange to say, that while the timber is highly spoken of in the southern localities of New South Wales I have mentioned below, it is hardly ever used. Now this does not indicate that it is of little value, as some cynics who delight to sneer at native timbers infer, but simply that the public in the district are not yet alive to its value, and shippers are ignorant of its

occurrence in the particular locality. In a sparsely populated district the local demand for even a popular timber will be readily satisfied, but when we consider the case of a little known timber, users are timid about giving an order for something of whose value they are at present ignorant. Still, even in the southern districts it is worked up to some extent, and it only requires that our people shall be informed that they have growing near them the true blackwood for them to use it a good deal more. I know of a Braidwood tradesman who has made, for many years, articles of the local blackwood. His work has a deservedly good reputation, and he does not make chests of drawers, secretaires, plate-chests, &c., out of a timber of whose value he has any doubt. I know of another tradesman at Delegate who used to make beautiful gun-stocks of it. The price he gets for his gun-stocks is so high that I am afraid to mention it, as everybody may turn to gun-stock making. Another tradesman uses it for buggy naves. He from time to time goes out and cuts down a fair-sized tree, lets it season outside in the log, and cuts length by length off as he wants it.

The manufacture of gun-stocks from this timber is a very old industry, particularly in Tasmania. I find that in the season 1844-5 that 430 gun-stocks were exported from Launceston to Great Britain.

A number of tests have been made in regard to the strength of blackwood, but as it is unsatisfactory to make an abstract of experiments of this kind, I give a list of the most important of them, in order that architects, engineers, and others interested may readily refer to the originals :—

1. Tests of the timber experimented upon by the Victoria Timber Board, Railway Workshops, Newport, Melbourne, 1884.
2. Experiments on the tensile strength of a few of the colonial timbers. F. A. Campbell, in Proc. Roy. Soc., Vict., 1879, p. 6.
3. Experiments on the transverse strength of the wood of *Acacia melanoxylon*, by Baron Mueller and J. G. Luehmann ; Cat. Timbers, Tech. Museum, Melbourne, 1885.
4. Australian Timbers ; by Professor Warren. An exhaustive series of tests published under the auspices of the N.S.W. Commission for the Chicago Exhibition, 1893.

The Mudgerabah as a Shelter-tree.—The traveller in New England cannot fail to notice a symmetrical, umbrageous tree, usually some 40 or 50 feet in height, with a trunk-diameter of 2 or 3 feet, and with a great spread of leafy branches. It has rough bark, and its leaves remind some country people of " some sort of a gum-tree." When in flower or seed it will be noticed to be a wattle. It is found a few miles from the coast, at an elevation of about 2,500 feet above sea-level, and I noticed it all over the New England country, even at Guy Fawkes, the summit of the Snowy Range, and the highest point of New England. The climate here is very severe, yet the trees of this Acacia are magnificent specimens, showing how hardy it is. It is everywhere called Mudgerabah, and it is about the only tree that pastoralists do not ringbark, as it gives a grateful shelter to the stock during the summer, while, in those districts where frosts occur, the cattle are found under it during the coldest nights, as the frost cannot penetrate the dense foliage. From the æsthetic point of view, it is desirable that these trees should be conserved, for they are charming objects in the landscape, many of them being as nearly symmetrical as it is possible for a tree to be. This tree is none other than the blackwood. From the point of view of the timber-getter, the trunks of the Mudgerabah are usually too short, but if it be necessary to fell one, the timber deserves a better fate than to be utilized as fuel.

Size.—In the southern mountain districts, there are many trees 70 or 80 feet in height, with a stem diameter of 2 or 3 feet. The Mudgerabah, which may be taken as a type of the northern New South Wales form, is usually 40 to 50 feet high, and also has a diameter of 2 or 3 feet. In Tasmania and Victoria, it is as large and larger than those in the southern mountain districts of New South Wales.

Distribution.—The blackwood is best known as a Tasmanian and Victorian tree, but it is extensively distributed in the southern mountainous districts of New South Wales. It then seems to skip over the immediate neighbourhood of Sydney, but reappears in the rising country at the back of Port Stephens, and is extensively distributed in the tableland of New England, extending into Queensland. From Port Stephens to Queensland it is frequently found wherever the elevation is not less than 2,500 feet. What its precise western boundary is we do not know at present, but I have seen it from Tenterfield, Glen Innes, Boggabri, and near Armidale. It occurs abundantly in the Mudgee District. It is plentiful in the Richmond River District, occurring in places at no great elevation, and at no great distance from the sea. As far as southern New South Wales and Gippsland are concerned, the blackwood must be considered as a mountain species, though it occurs occasionally in the low coast land, but there it never attains any size. It varies a good deal in mode of growth, according to situation and geological formation. In the rich humus of the jungle of the mountain slopes, it attains a height of from 60 to 80 feet, and in Gippsland, along the boundary of New South Wales and Victoria, localities may be found where it attains a height of 120 feet, and a diameter of nearly 3 feet. There, straight trunks may be seen without a limb, from 60 to 80 feet, the timber quite sound, and possessing that beautiful dark colour whence the species has derived its popular as well as its scientific name. When it grows on high mountains, as on the Delegate and Tingiringi Mountains, amongst rocks and precipices, it grows very gnarled and spreading, from 20 to 40 feet high, and from 1 to 2 feet in diameter, sending out thick, long, gnarled, and crooked limbs quite close to the ground. Mr. W. Bäuerlen tells me that on the Delegate Mountain he has seen them as low as 1 foot from the ground, with the limbs of great length, and eventually touching the ground. Those trees furnish most beautiful timber, as far as grain and figure are concerned, but generally not quite so dark as the timber growing in the rich soil, but the situations are mostly inaccessible to vehicles of any kind. As regards the southern part of the Colony, the Clyde Mountains, Braidwood, and the Bateman's Bay District, may be considered the most northern localities in New South Wales for blackwood of commercial sizes. From thence, it can be obtained all along the coast range right down to the southern boundary, where, as has been already stated, it attains its greatest luxuriance in the brush country, in common with sassafras, musk, and other well-known plants. On the mountains east of Bombala, Nimitybelle, and Cooma, but yet on the high tableland, there is a belt of forest fringing the Monaro Plains. This forest, where it is intersected by its numerous creeks, valleys and gullies, should furnish a plentiful supply of blackwood. It has been but imperfectly prospected for that valuable timber, yet plenty of trees 2 feet and more in diameter have been seen, with trunks furnishing logs from 20 to 40 feet in length. This is a favourable locality, since carriers go from thence to the Cooma railway station on the west side, and to the seaports of Merimbula and Twofold Bay on the other. The eastern mountain slopes near Candelo, Colombo, Bega, Cobargo, Tilba Tilba (Dromedary), and Moruya, contain also a large supply of this timber.

Propagation.—From seed, which is readily purchasable. I recommend this valuable tree to be conserved and planted in the cooler, moist districts of the Colony, *i.e.*, in the coastal and dividing-ranges and table-lands. It is also a shady, ornamental tree, and hence is often cultivated in Sydney gardens. With me, it has grown 20 feet high in three years—healthy, thick foliaged trees. This tree has been extensively cultivated in Madras for revenue purposes, but the wood has been found to possess there few qualities prized by the cabinet-maker and builder. It warps after many months of seasoning, is not easily worked, and is not as durable as other timber accessible to the residents of the hill stations. The slowness of growth is much against the tree, and where it has been tried, in two instances, as an avenue tree, it has proved a failure. It is liable to attacks from a mistletoe. As a fuel tree it is not prized so highly as *A. dealbata* (Silver Wattle). The blackwood was introduced on the Nilgiris in 1840, and is now completely naturalised. It is also being grown on the hills of the Punjaub, Kumaun, and Sikkim, in India. I am not surprised at the want of success with this tree in tropical countries.

References to plate.—Acacia melanoxylon—1. Leaf (phyllode) from Ballina, N.S.W.; 2. Leaf (phyllode) from Hobart, Tasmania; 3. Flower-bud (largely magnified); 4. Individual flower (largely magnified); 5. Ripe pod (without seeds), less than natural size; 6. Seed, showing funicle twice encircling it, about natural size.

No. 8.—A Spear or Corkscrew Grass.

(*Stipa setacea*, R. Br.)

Vernacular name.—Owing to the spear-shaped ripened seed, to which is attached a long awn. Called "Corkscrew Grass," owing to the twisted, corkscrew-like appearance of the lower part of the awn.

Botanical name.—Stipa setacea R. Br. *Stipa*, Latin for "tow," in allusion to the feathery awns of the original species (*S. pennata*). In our species the awn is naked. *Setacea*, bristly, in allusion to the fine leaves. *S. setacea* is found pretty well all over Australia, and hence it is not surprising that it varies a good deal. For instance, the leaves vary in width, and also in length, and we have figured both narrow and broad-leaved forms.

The genus *Stipa* contains about 100 species. Australia claims fifteen, New Zealand two, one* of which is also found in Australia, while the others are natives of America and Asia. The United States has twenty-three species, and some of these have well marked varieties. In that country they are not, at least at present, accounted of much importance to the grazier, and no experiments appear to have been undertaken to determine their specific fodder value.

Botanical description (*Flora Australiensis*, vol. vii, p. 568) :—

Stems.—Slender, 1 to 2 feet high, or rarely more.
Leaves.—Fine and short, tufted at the base of the stem. Those on the stem few, with long sheaths.
Ligula.—Elongated, not ciliate; often broken off from dried specimens.
Panicle.—Loose. 4 to 10 in. long; glabrous.
Outer glumes.—Very thin, narrow, acuminate; 4 to 5 lines long.
Flowering glume.—Much shorter; pubescent or villous; entire at the top.
Awn.—Glabrous; very fine; 1½ to above 2 in. long.
Palea.—As long as the glume; often hardened when ripe.

* Two, if *S. petriei* be reducible to *S. setacea.*

The wide diffusion and variability of this grass have already been alluded to. In some forms the panicle is much looser than shown in our drawing; in others, the amount of twist ("corkscrewness") of the awn varies, and other points of variation might be mentioned.

Size and habit.—An erect growing grass, attaining a height of 2 feet and more. When old the stems are sometimes almost cane-like, and the roots almost bulbous.

Value as fodder.—Although this is a rather coarse grass, it is useful on account of its drought-resisting qualities; it is much relished by stock of all kinds, and is very nutritious while young and tender. Mr. Bacchus says of it: "By reason of its early growth of nice tender herbage, which stock are fond of, it constitutes a useful part of the supply of early annual grasses." There is no doubt at all that it is a really valuable grass before the "seeds" ("spears") ripen, and hence it is admissible into the category of "useful plants," but a sad drawback to its value is the danger to sheep and wool from these seeds. They are produced in large quantities, are caught up by the wool, and by the mouth and nostrils. The structure of the "seeds" is sufficiently shown in the drawing, and they work home as certainly as a corkscrew or a gimlet. Mr. Bacchus says: "I once lost 800 out of 2,000 lambs by placing them on a part of the run which had been rested for some time where this grass abounded, and was just beginning to shed its seeds, which penetrated the skin in hundreds; and, but for being able to get them shorn at once, I believe nearly all the lambs would have died." Mr. Alfred Hawkesworth, who has had a good deal of experience in such matters, has been kind enough to give me the following note on the terrible havoc spear-grass sometimes works with sheep:—"Of all grasses and weeds, spear-grass seeds are the most damaging to sheep and wool. Being straight, and with sharp-pointed ends, when once they get attached to the wool they lie parallel with the staple and fibres, and by the movement of the animal they work their way on to the skin. In extreme cases the fleece is composed of fully 75 per cent. of spear-grass seeds, so persistently do they hold on to the wool. When once they get a hold, they never fall out. In the same way, when these sharp-pointed seeds enter the skin, they work through it, right into the sheep, until they come in contact with the vital organs, which results in certain death. I have seen them in the heart of a sheep, and even having a hold on the bones, from which they could not be pulled; they would break off. I once saw a mob of sheep that had travelled from Hughenden to Townsville (Queensland), where they were slaughtered, and the spear-grass seeds were so dense and tenacious that they had to be cut through, in order that the skins might be released; also, all through the body, to the intestines and lungs, they were present in large quantities. The face, also, suffers greatly, making the sheep blind in a very short time. I am of opinion that spear-grass country is only fit for cattle." This bad character must not be borne entirely by *S. setacea*, as some other Australian species of *Stipa* contribute to this result, and the blame must be borne by them jointly. Spear-grasses are also credited with destroying a large number of young chickens.

Stipa spartea is also injurious to sheep in Manitoba, Canada. Mr. R. M. Christy observes (*Proc. Linn. Soc.* 1883-6, p. 57):—"This wide-spread species forms a more succulent grass than any other of the prairie grasses, and is locally known as buffalo-grass, spear-oat, &c. The fruits ripen in July, and the awns penetrate the hides of sheep and dogs, causing much damage to the settlers. They are very like those of *S. pennata*, but about $\frac{7}{8}$-inch in length, with an awn nearly 2 inches long, twisted nine or ten times. Rather more

than 3 inches beyond, it is produced into a delicate bristle, which does not twist, and many small teeth pointing upward; when wet, the whole awn is perfectly straight. The author experimented in August, November, and December upon *S. spartea* and *S. pennata*, and found that actual penetrative power was possessed by the hygrometric awned seeds. Butchers repeatedly find these seeds embedded about half an inch beneath the skin of animals slaughtered by them, and animals have not infrequently to be destroyed on account of their being infested with these fruits."

Other uses.—Nil. This and other species have toughish stems when old, but none of them approach the Esparto (*S. tenacissima*), in this respect.

Habitat and range.—Found in every one of the colonies, from the coastal districts to the deserts of the centre of the continent.

References to plate.—Stipa setacea—1. The long ligule; 2. Spikelet (opened out a little); 3. Outer or empty glumes; 4. One empty glume, showing venation; 5. Flowering glume, with awn; 6. Flowering glume, entire at top. All variously magnified. A, filiform leaves (type form); B, an old plant from western New South Wales.

Stipa setacea, R. Br.

"A Spear Grass or Corkscrew Grass."

Walking-sticks and Umbrella-handles from New South Wales.

By J. H. MAIDEN.

A COUPLE of years ago I issued the circular referred to below to personal friends and correspondents. I received a number of valuable replies in consequence. Through the pages of the *Gazette* I am enabled to appeal to a wider audience, and I beg to bring the subject under the notice of its readers.

Walking-sticks, canes, umbrella-handles, &c., of one sort or another are always in demand. At present, although we import a very large number of finished sticks, our quota to the world's supply of raw sticks is mainly limited to a few Mitchenbills* or Walking-stick Palms (*Kentia monostachya*). It is a matter of everyday remark that sticks of a useful or ornamental character are noticed in the bush, and are either passed by or cut down for temporary use and then cast away. But in the ornamental or curiously-shaped sticks that we so often see in the bush, I see a prospective minor industry. The collecting of sticks is not going to rival gold-mining, but the accumulation of them at odd times (like the gathering of certain gums and resins), will be remunerative as soon as our people have learnt how and what to collect. Sticks of the kind required will not take up much room, nor are they objectionable in any way. If each family in the bush can make just a few pounds a year out of sticks, it will be with no interference with the ordinary duties of each member; but it will only lead to disappointment if sticks be gathered without reference to what will probably be required, and therefore the hints which follow are commended to careful consideration.

[CIRCULAR.]

I am collecting information in regard to the suitability and availableness of Australian saplings and timbers for walking-sticks, umbrella and parasol handles, and I shall be grateful if you will help me in the inquiry.

I have jotted down the following general notes *re* walking-sticks. They should possess :—

(*a*) Rigidity.
(*b*) Strength.
(*c*) A good root or excrescence to form a handle.

Weight is not material. Straightness is not absolutely essential, as any sticks can be straightened by suitable processes. They should taper to the end. There should be facilities for collection and shipping, as they would require to be delivered at the port of shipment at a very low rate.

Sticks are of two kinds :—

1. Those cut out from the solid, *e.g.*, Forest Oak, Native Pear, Blackwood, Red Ironbark, and the outer portion of the stem of the Cabbage Palm.
2. Saplings, such as Tea-trees, Wattles, small Palms, and innumerable others. It is to this class that we should mainly look for suitable sticks.

There are innumerable kinds of suitable saplings to be obtained, and they might be procured at odd times by children and others, kept until a fair number accumulate, and then disposed of.

Peculiar sticks, such as saplings with twiners round them, are desirable.

* *Vide* note, p. 138.

In the course of this inquiry I put myself into communication with Messrs. Henry Howell & Co., cane and stick manufacturers, of 180, Old-street, London, E.C., who are well known to be far and away the largest firm in the trade. I found that this firm had published some hints on the subject, and following is a copy of their circular:—

POINTS TO BE OBSERVED IN COLLECTING RAW STICKS, CANES, &C., FOR WALKING-STICKS, UMBRELLA HANDLES, &C.

Length.—The total length should not be less than 42 inches, end to end, but if possible they should be 48 inches.

Size.—The best sizes are of the diameter of ½ inch to 1 inch, measured about *midway*; they should not be larger than 1¼ inch in diameter.

Form.—It is indispensable that the diameter should gradually diminish from the root or handle to the point, so that the stick is not "top-heavy."

Handle.—It is always better, when possible, to send sticks with some kind of handle; if the plant be pulled up, the root should be left quite rough and untrimmed; if a branch be cut off, a part of the parent branch should be left on to form a knob or crutch handle.

Sticks without handles.—Sticks without handles can be used, especially if they are nicely grown, and have any peculiarity of structure or colour—but if there is any handle, however small, it should not be cut off. Young saplings of the different kinds of palms, bamboos, &c., &c., should always have the root left on.

Short handles.—Occasionally, the form of the root or handle part is attractive, while the stick itself is weak and defective; in such cases the handles only should be sent, and they should measure from 15 to 18 inches in length.

Send only specimens in first instance.—In sending specimens of new sticks it is better to send only small quantities, say, one or two dozens of each kind; then, if approved, further quantities can be asked for.

All kinds of wood.—Specimens of anything remarkable for form or colour, whether in the roots or stems of woody, herbaceous, or reedy structures should be sent, as sometimes the most unlikely things are found to possess value for use either as umbrella handles or walking sticks.

Details.—Details as to quantity to be procured, prices, &c., should be sent, if possible.

I addressed a number of questions to Messrs. Howell & Co., and perhaps it will be better to quote their reply as fully as possible:—"The subject to which you refer, viz., 'the collection of raw sticks suitable for walking-sticks or umbrella handles,' is one in which we need hardly say we are particularly interested, and we are very much obliged to you for the way in which you are endeavouring to bring it before the people in Australia. From time to time we have seen sticks from the different colonies of Australia, and there has been a considerable quantity of one or two varieties sold in this market, the principal one being the midgeon* cane, which we believe came from the neighbourhood of Brisbane. In an article in the *Gardener's Chronicle* of 27th January and 3rd February, 1877, written by Mr. J. R. Jackson, curator of the Kew Museums, that gentleman gives a list of sticks from Australia, amongst which he mentions the Cardwell cane (a species of *Calamus*), also the Loya,† apparently of some species of calamus or rattan, but of very small diameter, and with fantastic rustic roots; there is also the bramble, which possesses a root something like a potato, and which grows to a pretty good size, but none of these canes seem to have met with any success beyond the Midgeon, and unfortunately this has gone completely out of fashion, so that at the present time it is a complete dead letter in the market. We think, however, that there must be a very large number of plants which would be suitable either for walking-sticks or for the handles of sunshades or umbrellas,

* *Kentia* or *Bacularia monostachya*, the Midginbill or Mitchenbill or Walking-stick Palm of our northern rivers (N.S.W.), and usually known in Queensland as the Midgeen Cane.

† (?) A corruption of Lawyer.

and if you could succeed in getting any intelligent collector to send us samples, we should be very glad to give our opinion as to their value, and if we saw any chance of using them, to give orders for a sample parcel in order to try the market. The present time is peculiarly suitable for the introduction of some new articles of this character, as the staple sticks now in use have had their day, and the trade generally would be glad of something new. It is, however, quite a mistake to suppose that any kind of stick possesses a value; it is essential there should be some peculiarity in the sticks themselves, which will render them attractive, otherwise they are reckoned almost as firewood, the price realised for which would not suffice to pay the freight. In other words, we should not want firewood sent from Australia.

"We note with much interest your printed circular in regard to the collection of these goods, and we must say that you have indicated with remarkable exactness the class of goods which would be likely to prove most useful in the market here, and consequently of commercial value. Especially is this the case with the description you give under No. 2, viz., saplings such as tea-trees, wattles, small palms, &c. We think that something new in palms or natural saplings would be more than anything else likely to meet with a demand here. Sticks cut from the solid, unless having a peculiar marking like figured ebony, palmyra, letter-wood (or snake-wood of British Guiana), do not seem to meet with any favour. We should like, however, to see a specimen of the stem of the cabbage-palm. If the outer hard portion should be of sufficient thickness to make a rigid stick, we think there will be a good deal of character in it. Of course it is understood that our sticks are finished, and consequently are very much smaller, especially in the handle part, than they would be in the rough state. We like all sticks sent untrimmed, the root or handle part left as large as possible, so that we may use our own discretion as to the form of handle we may make. The round hook sticks, you will easily understand, are artificially bent, so that it does not follow that all sticks without handles are valueless, provided they possess some distinctive character, so as to be of use either for bending, or having artificial heads put on them. Seeing that they are usually sent with the bark on, which has often to be removed, the size of the sticks should be about 1 inch in diameter, measured about midway.

"As to the kinds of wood which can be used in our trade, it will be sufficient to point out that large quantities of mullein (or *Verbascum*), teasel (or *Dipsacus*), as well as certain kinds of Cacti, the woody structure of which presents a very remarkable appearance when cleared of the fleshy matter which is so abundant on this plant, have been employed as sunshade handles, and they make a very light and graceful handle. We think it would be well if you could get some person to interest himself sufficiently to study the matter, and to send us about a dozen of each specimen of wood which seems at all likely to be useful, taking care to keep duplicates of the same properly numbered, so that in the event of an order being given there might be no doubt as to their identification, and as to what is required. If they are addressed to us, we will give a prompt reply as to the kinds which might be utilised. We think it is as well to mention that it is most unadvisable for any large quantity of sticks to be sent away unless they are properly selected to suit the market. We have known several instances of persons having done this, who have invariably lost money by it. To sum up the matter, we may say that we should like to see specimens of every kind of palm which can be obtained in Australia, also anything of an herbaceous character, having, when dry, sufficient rigidity to carry a sunshade. In addition, any kind of wood which

possesses any kind of 'figure' on the surface of the bark, or on the wood immediately under the bark. We have used an enormous quantity of English furze (*Genista*) lately. This, as you know, is very peculiar in its structure, having holes and knots in the wood, which when finished present a very distinctive appearance. Anything of the 'Genista' type we should think would be likely to be of some use. Some time ago we saw some sticks purporting to come from Australia, called the 'Australian Bay.' It had a peculiar nutty brown bark when dry, with longitudinal indentations, and was inclined to be somewhat flat or square-sided, rather than rotund. A stick of this kind, if it could be obtained with a good handle, would certainly be of some value here. In reference to the prices and quantities of sticks which might be imported, you will see from our observations that it is impossible to furnish this information until we have seen the woods and been able to form some idea as to their value."

In a list of sticks supplied to the London market, I find that small saplings of Tasmanian Blue-gum (*Eucalyptus globulus*) are supplied by Algeria, and none from Australia. Orange and lemon sticks are supplied by Algeria and the West Indies. Surely we could supply these as cheaply as anywhere else.

The variety of sticks we could supply with our remarkably rich vegetation should be unusually great. The industry seems to be full of bright possibilities, but, as this article has already exceeded the length I had intended, I will defer any further remarks to a future issue of the *Gazette*.

No doubt many gentlemen who do not desire to enter into the collection of sticks themselves will be able to furnish the Department with valuable information, which will further the industry as far as this Colony is concerned. In such cases, letters addressed to the Under Secretary for Mines and Agriculture will receive careful consideration. Those who are prepared to embark in the industry at once, or who have accumulated specimens of what they deem to be suitable sticks, are recommended to communicate with Messrs. Henry Howell & Co., direct, at the address given above.

Botanical Notes.

BY J. H. MAIDEN.

TWO PLANTS POISONOUS TO STOCK, FROM WESTERN AUSTRALIA.

MR. W. E. ASH, of Albany, Western Australia, has been kind enough to send to the Department specimens of two plants injurious to stock in that colony, and has been kind enough to furnish some notes with them.

Some additional information is herewith given in regard to these plants, which have interest for many Australian stock-owners. The only way to destroy such plants appears to be to frequently burn them off.

No. 1.—Heart-leaf Poison-plant of the Albany District, Western Australia.

(This is *Gastrolobium bilobum*, R. Br., N.O. Leguminosæ).

Mr. Ash states:—"There is said to be another heart-leaf poison to the northward, but this is the most common and very thick in places, more especially about granite outcrops. It grows to a large often-spreading shrub, 6 to 12 feet high, with stems 2 or 3 inches, but sometimes 10 inches in diameter. Said to kill ruminants very quickly, like heart disease. After showing signs of the poison, bleeding is said to cure some cases, which take two or three years to recover."

Bentham, in the *Flora Australiensis*, characterises this plant as the worst of the poison-bushes. There are several other species of *Gastrolobium* in Western Australia, which have played deadly havoc with flocks and herds, such as *G. calycinum*, the York Road poison-bush, *G. ovalifolium*, the Broom poison-bush, and others which are simply known as poison-bushes. One species (*G. grandiflorum*) is found in North Queensland, where it is known as the Wallflower and Desert Poison-bush, and is much dreaded by stock-owners.

With the exception of some brief notes by Dr. Rosselloty, who brought the subject before the Intercolonial Medical Congress of Australasia in 1889, no recent observations have been made on these poison-bushes. In the early forties, when Western Australia began to be largely stocked, a good deal of attention was paid to these plants, for their fatal effects spread dismay amongst stockowners.

Drummond, who collected largely for Kew, thus reports in Hooker's *Journal of Botany*:—"The finest and strongest animals are the first victims; a difficulty of breathing is perceptible for a few minutes, when they stagger, drop down, and all is over with them. After the death of the animal the stomach assumes a brown colour, and is tenderer than it ought to be; but it appears to be that the poison enters the circulation, and altogether stops the action of the lungs and heart. The raw flesh poisons cats, and the blood, which is darker than usual, dogs; but the roasted and boiled flesh is eated by the natives and some of the settlers without their appearing to suffer any inconvenience."

Mr. T. R. C. Walter, in the *Pharmaceutical Journal*, vi, 311, says:—"The blossoms are also frequently eaten by animals, and are, I think, the most poisonous part, for the greatest number of sheep are lost from the poisonous effect of this plant at the period of its inflorescence. When the seeds fall on the ground, the wild pigeons greedily feed and fatten on them; if the crops of these pigeons, containing the seeds, be eaten by dogs, they die; yet the pigeons themselves, when dressed, are good food, and at that season are eaten in large numbers by the settlers. Horses, so far as is known, are not affected by it, at least this is the prevailing opinion, although it is disputed by some of the settlers. . . . When sheep have eaten the herb, the best treatment has been found to fold them, or shut them up in a close yard, so closely packed that they can hardly move, and to keep them thus without food for thirty-six hours."

The plant has yellow or orange flowers, and the leaves are narrow heart-shaped, or rather wedge-shaped. The pod, at all events in its young state, is covered with white silky hairs.

No. 2.—Candyup Poison.

(This is *Stypandra glauca*, R. Br., N.O. Liliaceæ.)

Mr. Ash states:—"This is a herb which is said to cause animals that have fed on it to go apparently blind and run into any sort of object. It seems to be the least fatal of all the poison plants. It is slower in taking effect. It is found in the vicinity of the South Coast."

This plant is common in the neighbourhood of Sydney, the Blue Mountains, and many other parts of this Colony, but I have never heard of it having been reported as a poison plant here. But in Western Australia it is much more abundant than it is with us, and it has so frequently and so consistently been reported as the cause of the "blind disease" in sheep that there appears no room to doubt its dangerous nature.

The Stypandra grows up to 2 or 3 feet high, has blue flowers, and distichous leaves 2 to 4 inches long.

Fluky Grass.

New England squatters have several times sent to the Department a plant which is known to some of them as Fluky Grass, and they ask whether it causes fluke in sheep or not. Its botanical name is *Schœnus Brownii*, Hook. f., and it belongs to the natural order of Cyperaceæ. It certainly, to the ordinary observer, resembles a grass, having grass-like leaves up to about 6 inches in length. The infloresence is of a darkish colour, hence it was described to me once as "a little black-headed grass." It is very indigestible, containing practically no nutritive matter, neither does it contain any injurious substance which would induce fluke. *Schœnus Brownii* as a rule grows in damp situations, and it will probably be found that the climatic conditions which favour the growth of this sedge are also favourable to the development of fluke, and the existence of the sedge and fluke are coincident merely. Every week a plant is sent with the report that it is believed to have this or that effect on stock, but in the majority of cases the senders have made incorrect or superficial observations. To say with certainty that the eating of a certain plant by stock produces certain effects, necessitates a series of very careful observations, and every precaution must be adopted to preclude disturbing influences of every kind. Incorrect observations in regard to plants eaten by stock are by no means peculiar to Australia, and old ideas as to the effects of certain plants are being constantly exploded. As bearing upon the present subject, I give an extract from

Sowerby's "English Botany" in regard to a plant considered to produce fluke in sheep in the old country, and the lesson it teaches is, I believe, applicable to the case of the New England so-called "Fluky Grass."

"*Hydrocotyle vulgaris*, Linn.—"The Marsh Pennywort" of England.—"There is a notion amongst farmers and others that this plant is injurious to sheep or cattle that may feed upon it, and it has accordingly been called white rot and fluke-wort. . . . The error in this notion is in ascribing the mischief to any particular plant, rather than to the situation which favours the growth of the plant, and engenders disease in the animals. Were the ground drained, the marsh-loving plants would disappear, but so also would the illness in the sheep which fed in the pasture. Many calamities amongst cattle are by ignorant farmers attributed to their feeding on these marsh plants, which in reality result from the boggy damp grounds on which they live, and in which alone such plants will grow; were the plants gathered and given to the animals on dry ground, we feel sure that no harm would come to them."

AN OAT-GRASS.

Andropogon avenaceus, R. Br., has been sent to the Department from Forster, Cape Hawke, as a palatable and fattening grass for cows. It is apparently sparingly distributed in New South Wales, having hitherto only been recorded from the Clarence, and a few localities between it and Port Jackson, so that its present locality is interesting as a record.

HOP-BUSH AS A MEDICINE.

THERE are two kinds of so-called hop-bushes in this Colony, the *Dodonæas* (Natural Order Sapindaceæ), which are called hops, because of their bladdery fruits, and the *Daviesias*, shrubs with yellow or orange-coloured flowers of a pea-shape, and belonging to the Natural Order Leguminosæ. The *Daviesias* are called hops because of the intensely bitter taste of their leaves. These plants are common in the coast and mountain districts of this Colony, and inquiries are often made about them on account of their bitterness. Horses and cattle nip at them, and without harm to themselves, I believe. It is said that horses are fond of the non-prickly leaved species. A gentleman from New England wrote to the Department a short time ago about *D. latifolia*, a species with broad leaves. As far as I know, the plant is a useful tonic bitter, and therefore a readily available substitute for gentian for country people. I have never known it to produce unpleasant effects, but, although I have chewed it hundreds of times, I have never taken it in large quantity, as the bitterness is too intense. The leaves have not yet been analysed, so we do not know the nature of this bitter principle. Unfortunately it is only one of hundreds of Australian native plants which are awaiting their turn to be analysed. Some years ago, Mr. James Stirling, the Victorian Geologist, told me that some Gippsland miners used a decoction of hop-bush leaves in certain complaints, but too much reliance must not be placed on empirically applied remedies. In a note to the Royal Society of Tasmania some years ago, Mr. Alfred J. Taylor said he had been assured that some remarkable cures of hydatids had been effected in Victoria by the administration of an infusion made from the leaves of this plant. I wish I could secure the interest of a few pharmaceutical chemists in the country districts in examining for alkaloids, glucosides, &c., plants which I would with pleasure indicate to them. Some of our country friends have a little more leisure than we in town, and those who engage in the kind of research I have indicated may win a good deal of *kudos*.

On the Choice and Use of Artificial Manures.

By F. B. GUTHRIE,
Chemist.

The practice of using artificial manures has extended so largely of recent years, that I suppose there are few cultivators in this country who have not tried the effect of one or other of the numerous "complete fertilizers," or "special manures," local or imported, on the market.

Their use is steadily on the increase in the Colony, as the land, after repeated croppings, year after year, without manure, becomes impoverished, and yields diminishing and unremunerative crops. The experience gained by others points most conclusively to the benefits to be derived from the proper use of such manures, whether used in conjunction with farmyard manure as dressings in special cases or even as a substitute for farmyard manure, and the results may be readily verified by yourselves.

Nothing is easier than to make an experiment upon a small portion of your crop, a portion sufficiently small to occasion no inconvenience if the experiment fails, but large enough to enable you to judge of its effects. Top-dress a portion of your young wheat crop with a mixture of superphosphate and sulphate of ammonia, and compare the yield of the portion so treated with the remainder. Treat a few square yards of your potato-patch with kainit in the drills when sowing, and treat this portion subsequently in exactly the same manner as the rest of the patch. A shilling or two will cover the cost of these experiments, and the results will enable you to contrast the action of the manure even more satisfactorily than if the whole crop had been manured. If the crops respond to this treatment you will be justified in looking forward with confidence to a similar benefit on treating the whole of the succeeding crop in the same manner.

Manuring of any kind is a question of pounds and shillings. If the addition of 2½ cwt. of superphosphate per acre produces a yield of over 6 tons of turnips as against a fraction over 1 ton produced on the same land without manure, then the expenditure of about 18s. 6d. per acre on superphosphate is surely a profitable investment.

The numbers given in the above example were obtained in experiments by Messrs. Wrightson and Munro, and are quoted haphazard from a number of similar results. The figures are readily verifiable by anyone, and are indeed continually being put to the test by farmers every day.

Artificial manures are, however, somewhat expensive, and their use on a large scale, unless the principles upon which their action depends are properly understood, will be likely to result in waste of money without any commensurate benefit to the crop or the land. The selection of the manure most likely to benefit in a particular case involves a knowledge of the capabilities of the soil and of the requirements of the plant, and requires a considerable amount of judgment.

I propose, therefore, in the following pages to discuss, to the best of my ability, and divested, as far as it is possible of technical language, the requirements of the different crops and soils, and the function of different manures in supplying those requirements.

In the first place, as to the chemical composition of the plant, I shall endeavour to deal with this subject as broadly and generally as possible, so as to avoid technicalities, and only attempt to bring into prominence the most essential points which will enable us to understand the connection between the chemical requirements of the plants and the part played by the soil and manures for their provision. We shall not go far wrong if we assume that nearly all plants are built up of the same elements combined together in different proportions. They are carbon, hydrogen, oxygen, nitrogen, sulphur, phosphorus, silicon, chlorine, and about half a dozen metals in combination. It is in the relative proportion of these elements and their compounds to which the great differences in the chemical composition of the various plants are due.

Different combinations of carbon, hydrogen, and oxygen give us the large class of bodies known as carbo-hydrates, including such dissimilar substances as starch, sugar, the woody structure, cellulose, gum, &c. Hydrogen and oxygen combined give us water; nitrogen, united with the above elements and sulphur, forms the nitrogenous constituents, such as the gluten in wheat. Of the little that is known as to the formation of these substances in the living plant I do not here propose to dwell on. Even less is known of the metals;—their disposition in the plant and the changes they undergo. We are able to detect their presence in the ash in combination with oxygen, phosphorous, sulphur, and chlorine. The ash is that part which remains after the plant is burnt. Now, not only do the quantities of the different elements vary in different plants, but in the same plant some elements are present in quantities out of all proportion to the others. Over one-half of the bulk of most growing plants consists of water. In watery fruit, such as the melon or cucumber, the percentage of water is as high as 90 to 96. Of the remaining portion of the plant the compounds of the metals rarely exceed 2 per cent., and are more often about 1 per cent. This you may readily prove by burning a weighed quantity of any green crop until a white ash, or nearly so, is left. The ash from every pound of such crop will not weigh more than 100 grains.

The point of importance for us to keep in mind is that each of these plant constituents is as necessary for the well-being, even for the existence, of the plant as any other, whether that constituent be present in large or small quantities. The substances found in the ash, though present in minute proportions, are as indispensable to the well-being of the plant as the elements found in the larger portion. Not only that, but if any single one of the ash-constituents is insufficiently supplied—if the potash is deficient or the iron—the plant likewise suffers, although the amount of such element does not in many cases amount to more than a fraction of 1 per cent. Now the volatile portion of the plant—that is, the water,—carbo-hydrates, nitrogenous matter—are for the most part abundantly supplied to them by air and rain, with the exception of the nitrogen in some plants; that is to say, about 98 per cent. of the food of the entire plant is derived from air and water. From the soil it extracts the remaining 2 per cent., consisting of iron, lime, magnesia, potash, soda, and perhaps manganese, combined with sulphuric, hydrochloric, and phosphoric acids, together with the nitrogen as already stated. These substances it is the function of the soil to supply, and where the soil, by reason of its nature, or from having

been exhausted, is unable to meet the demand, we have to assist it by means of manure.

The object, then, of manuring, is to assist the soil in presenting to the plant a portion of the food necessary for its growth; and though the food-stuff thus supplied is extremely minute in comparison with what the plant derives from other sources, it is nevertherless of the greatest importance, and its absence or insufficiency will affect the health of the plant quite as much as the absence of air or of sunlight or of water.

Of these ash ingredients the greater portion is found in all soils in quantities more than sufficient for the requirements of any number of crops; thus, iron, magnesium, sodium, manganese, chlorine, sulphuric acid, silica, are present in nearly all soils in greater quantities than the plant requires, so that there is little danger of the soil becoming exhausted as far as they are concerned. The ingredients, therefore, that we have to supplement by means of manure, are reduced to three or four, viz., lime, potash, phosphoric acid, and nitrogen.

Lime is probably present in most soils in quantities sufficient for the purposes of plant food, and it is seldom necessary to supply it with that object. Its principal functions when applied to land are, firstly, a mechanical one, in modifying the physical character of the soil, and secondly, a chemical one, in rendering available certain insoluble plant foods. Lime acts, however, directly as a plant food, and the different classes of artificial manures fall under one or other of the above headings, according as they supply lime, potash, phosphoric acid, or nitrogen.

The food thus supplied by the soil is taken up in solution by a peculiar process of suction by means of the roots. It is, therefore, necessary that such food should be in a soluble form to be of any use to the plant, which is unable to utilise insoluble material. This is what is meant by the mineral constituents being "available for plant food," and when the terms "latent" or "dormant" and "active" are employed, they mean simply insoluble or soluble in the water imbibed by the root. Those manures which are known as quick-acting manures are such as contain their potash, phosphoric acid, and nitrogen in a soluble form at once available for the plant; those which are slow-acting contain these substances in a more or less insoluble condition.

In these latter cases a gradual decomposition takes place in the soil, due to the action of chemical agencies within the soil and assisted by the action of the roots of the plant, by which the insoluble compounds are converted into soluble ones, and so become gradually available, the beneficial action extending over a longer period of time.

A good example of these two conditions is found in the state of the phosphoric acid in bone-meal and in superphosphate respectively. Bone-meal consists of bones ground to a powder, and the compound of phosphoric acid and lime which it contains is insoluble in water to any appreciable extent. In course of time the agencies at work in the soil render it soluble. Superphosphate is a compound, manufactured by treating bones or mineral phosphates with strong oil of vitriol, by which treatment a different compound of phosphoric acid and lime is produced. This compound being readily soluble is at once made use of by the plant, but is not so lasting in its effects as ground bones.

From the preceding considerations which I have endeavoured to make as clear and as general as possible without going into precise details we shall have realised that a definite relationship exists between the requirements of the plant and the nature of the food with which we have to supply it. All plants do not take up the constituents presented by the soil in the same

proportion, and are consequently benefited differently by different manures. No amount of nitrogenous manure will materially benefit the pea-crop, but a small quantity added to the land in which wheat is grown will produce a considerable increase in the yield. With all crops there is a special ingredient or ingredients which they require more than others. Some require potash, others nitrogen, whilst others do not thrive unless there is abundance of phosphoric acid.

What these special requirements are, and the nature of the different manure with which they are met, we will inquire into at a later stage.

We now know that in the selection of the proper manure for use in any special case, we have in the first place to consider the requirements of the crop in question, and secondly in how far the soil can supply those requirements.

The latter question is most satisfactorily answered by an analysis of the soil; but it must not be forgotten that it is not possible to analyse the soil with the precision that is attained in the assay of an ore, or the analysis of a manure. The manner in which soils are produced renders it impossible that any considerable area shall be of uniform composition. Slight differences in the composition of the original rock will materially alter the nature of the soil in the neighbourhood—in fact, the destructive agents at work in the formation of the soil, act so unequally, and are affected by so many local conditions, that it would be very astonishing to find a large paddock of uniform chemical composition throughout. Even if we could by any means obtain a sample which should represent the average composition of the soil, we are met with the further disadvantage that no method of analyis yet devised is able to give us much information as to the availability of the material for plant-food. We cannot reproduce in the laboratory the action of the natural agents upon the soil. We can estimate the total quantities of the food-constituents present, but we cannot accurately state how much is immediately available, and we cannot at all say what quantities will become available in any given time. Too much, therefore, must not be expected of a soil analysis. Of itself it is of little value. It is, however, exceedingly valuable when studied in conjunction with the nature of the soil, its physical properties, its surroundings, previous history, and climate. What soil analysis can do for us is to show us in what ingredients a soil is deficient; whether it contains substances injurious to plant-life; whether it would benefit by the addition of lime; and, generally, what treatment it requires, and what manures.

With regard to the second point to be taken into consideration in the choice of manures, namely, the requirements of the plant, we have more satisfactory data to work on. The experience of others as to the effect of certain manures, and the chemical composition of the plant itself, are guides to which we may safely submit ourselves. But here again it is possible to fall into error. The analysis of two crops (say wheat and a root crop) shows us that the wheat crop contains a far greater proportion of phosphoric acid than the roots, but we should be wrong if we assumed that the wheat would be more highly benefited than the roots by a manure containing phosphoric acid. As a matter of fact, root crops are specially benefited by phosphatic manures, and cereals in a lesser degree. Similar instances are numerous, and I draw attention to them simply as a warning that it is possible to misread the information afforded by chemical analysis, especially if we persist in relying upon it alone.

I have pointed out that this is more particularly the case in soil analysis. There exists, however, one analyst whose methods are open to none of the

objections I have enumerated, and whose results are so stated as to require no modification. You can consult him at all times without fee. His report is devoid of technical language, and is such as you can understand without previous knowledge. He is—the plant itself.

The following simple experiment, suggested by the great French authority, M. Ville, will indicate the manner in which the plant may be made to analyse the soil:—

Sow in close proximity, and upon the same piece of land, a small patch of wheat and a small patch of peas. The land should be unmanured, and both patches should have received the same previous treatment. The behaviour of these two crops will furnish you with a guide as to the quantities of nitrogen, phosphoric acid, and potash available in the soil quite as reliable as the most accurate chemical analysis.

If the two crops flourish equally well, your land is well supplied with the three ingredients above named.

If the wheat crop fails, and peas flourish, nitrogen is wanting, and the advisability of applying a nitrogenous manure suggests itself. If, on the contrary, the peas are sickly, the cause is probably deficiency in potash and phosphates.

Such experiments as the above we can multiply, as we learn more exactly the chemical requirements of different plants.

In short, the condition of the crops themselves, and the presence or absence of certain trees, grasses, and even weeds, will afford us a considerable amount of information as to the chemical character of the soil.

Chemical Notes.

BY F. B. GUTHRIE,
Chemist.

THE following analyses of blood manure, bonedust, and meat from the Bourke Meat Preserving Works may be of interest:—

Bonedust mixed with Meat.

Moisture	= 6·39	
Organic and volatile matter...	= 67·61	(Nitrogen = 6·804; ammonia = 8·262)
Sand and insoluble	= ·98	
Tri-calcium phosphate ...	= 22·47	(Phosphoric acid = 10·29)
Calcium carbonate	= ·88	

Mechanical condition.

Fine	= 38·5
Medium	= 56·0
Coarse	= 5·5

This is a highly nitrogenised bonedust, and its manurial value is £5 11s. per ton.

Blood Manure.

Moisture	= 10·63	
Organic and volatile matter...	= 83·99	(Nitrogen = 12·376; ammonia = 15·028)
Sand and insoluble	= 2·44	
Phosphoric acid	= ·83	

This is an excellent nitrogenous manure, in good mechanical condition, and should prove an excellent manure for wheat, grass, and root crops. The manurial value of its fertilising ingredients is £7 11s. per ton.

The above are obtainable at Messrs. Bartley, Hodgetts, & Co., 111, Sussex-street, Sydney.

Comparative Value of Farmyard Manure and Artificial Manures.

A correspondent having inquired as to the relative manurial values of farmyard and Sugar Company's manure, the following comparison may be useful to others.

One ton of farmyard manure contains, roughly, the following quantities of fertilising ingredients:—

Nitrogen	8 lb.
Potash	6 lb.
Phosphoric acid	6 lb.

In 3 cwt. Sugar Company's manure No. 3 there are of:—

Nitrogen	9 lb.
Potash	6 lb.
Phosphoric acid	42 lb.

That is to say, 3 cwt. of Sugar Company's No. 3 contains about the same quantities of nitrogen and of potash, and seven times the quantity of phosphoric acid, as 1 ton of farmyard manure.

The cost of 3 cwt. Sugar Company's manure is about 19s. 6d.

The manurial ingredients in the Sugar Company's product are in a very soluble form, and their effect is more rapid. On the other hand, it contains no vegetable matter like the litter in farmyard manure.

Composition of Fodders.

The following analyses of certain green fodders, as cut for feeding, may be of interest to farmers in indicating the relative feeding values of the different fodders examined :—

	Water.	Ash.	Fat.	Fibre.	Crude Protein.	Carbo-hydrates.	Nutrient value.	Ratio of Proteids to Carbo-hydrates.
Rape	79·06	1·85	·73	3·95	1·24	12·45	15½	1 to 11½
Mangold	86·15	·88	·44	1·13	1·91	9·49	12½	1 to 5½
Cabbage	86·28	1·07	·48	1·83	1·17	9·17	11½	1 to 9
Field-peas ...	81·75	1·21	·81	7·85	3·09	5·29	10½	1 to 3
Oats	80·12	1·72	1·19	6·73	2·57	7·66	13	1 to 4
*Sour ensilage ...	60·86	4·73	1·17	13·74	4·15	15·35	22½	1 to 4½
Planter's Friend...	73·32	·95	·55	6·06	2·28	16·84	20½	1 to 8
Imphie	73·91	1·08	·99	5·74	1·56	16·72	20¾	1 to 12⅓

* The amount of acidity in the sour silage was not determined.

National Prizes Competition, 1893.

By F. B. KYNGDON, M R.A.C.

Champion Farms.

(*Continued from page* 104.)

In the last number of the *Gazette* were published full details concerning each of the farms of the large class (over 200 acres and not exceeding 1,280 acres) entered for the Champion Prizes, and in this number I propose to deal in a similar way with the entries for the prize for the smaller class, viz., mixed farms up to 200 acres.

The following is a list of the entries in this class, with the percentage of points awarded to each :—

	Acres.	Percentage of points.*
Haywood Bros., Pambula	184¾	88·31
Bernard Muscio, Taree	50	86·42
E. J. Dening, Kempsey	22	84·10
J. W. Johnson, Grafton	53	81·05
H. M'Lachlan, Grafton	57	80·33
E. Gibson, Unanderra	103	78·94
D. Doust, Grafton	180	78·63
G. K. Green, Tumut	160	77·78
M. Waters, Hawkesbury River	100	76·44
W. Swan, Albion Park	160	66·31

The report on each property is given in the order of date of inspection.

G. K. Green, Tumut.

South Tableland District.—Place, No. 8; points, 77·78 per cent.; arable, 102 acres; pasture, 17 acres; homestead and paddocks, 3½ acres; orchard, 7½ acres; let off, 30 acres; total, 160 acres.

(16 October, 1893.)

This farm of 160 acres is distant 5 miles from Tumut, and occupies perfectly flat land, the deposit of the Gubragandra River, a tributary of the Tumut River, which borders the property on one side, the other boundaries being by public roads. Towards the south, and within half a mile, commence the foothills leading to the Bogong mountains, which quickly reach an elevation of 1,100 feet, and shelter from southerly winds, but those from the north sweep the plain. The character of the soil is fairly even, being a blackish

* See tables at page 192.

sandy loam, in many cases over 10 feet in depth, reaching to the boulder bed of the river, and therefore the permanent water-table. The highest land is nearest the banks, but, owing to their sloping away, water lies after rain in some of the paddocks, and much might be done to drain if neighbours could be induced to continue the open ditches to an outfall, and thereby improve their own land. These moist lands afford good grazing during summer, and the farm, as a whole, is certain to yield a crop every season unless an exceptional flood occurs. With water so easy to reach there is no need for its conservation save by tanks for household purposes.

The property was purchased off Michael Quilty seventeen years ago. Forty acres were then under cultivation, and the rest was a dense river scrub, the fencing being old and the house a sort of gunyah. Mr. Green, during nine years' occupation, has, with his own labour, a man being hired when needed, cleared all but 10 acres, erected substantial fences, built the present house and farm-steading, and brought the farm into first-class order. By reason of ill-health he next resided in Sydney for five years, when the land was leased for £200 per annum, but it fell off in condition, and Mr. Green having returned, has during the last three years restored it to the state it was in prior to letting. The purchase money in 1876 was at the rate of £4 16s. per acre, but the value may now be estimated at £14 per acre.

The paddocks are moderate in size and well fenced, principally with two-rail of very substantial build, of water-gum timber, the trees being of a large size, and are split by means of a charge of powder. Instead of burning off, posts and rails are got out for future use, and the rest of the timber is cut into firewood and stacked near the house, some 40 cords being stored there now. Old fences are strengthened to last for a time by means of wires run on the top and between the two rails. A Government road fence, rankly overgrown with briars, is about to be cleared and replaced by Mr. Green with post and two rails. Weeds grow apace in this fertile soil, and a just cause of complaint lies against the State through the neglect of keeping roads free from noxious rubbish. There are gates near the homestead and slip-rails elsewhere.

The residence is a substantial four-room slab cottage, roofed with iron, having a detached kitchen and offices, and standing in the midst of a flower-garden and orchard. Close by is a luxuriant clover-paddock bordering the river, and containing many very fine elms, willows, elder bushes, and a white cedar, which testify to the richness of the deep loam and its never-failing moisture. The farm buildings are at a distance of 200 yards, and comprise a slab-built stable, floored with slabs, milk-bail and yard with calf-pen adjacent, and the barn 60 ft. x 20 ft.

The implements comprise a one-furrow plough, by Howard, a two-furrow plough, by Ritchie, wood-framed harrow, Howard's A-shaped horse hoe and scarifier, "Planet" horse-hoe, wood-roller, A B C corn-sheller, spring cart, tip-dray, and buggy; reaping and threshing machines and chaff-cutter are hired.

The system of farming pursued is to alternate maize with oats, some of the latter being cut for grain, and the rest for hay. A small breadth of wheat is also grown for sale to local millers. The bulk of the maize and oats with surplus of the hay over home consumption is sold locally. After the corn is pulled, cattle pick up a good living all the winter, and the land, when rest is required, is laid down in grass for some years before being again cropped with cereals. After the oats are cut, stock are allowed to run on the stubbles till May, when ploughing follows.

The farm is laid out as follows:—Maize, 71 acres; oats, 23 acres; wheat, 8 acres; cultivated, 102 acres; pasture (rest), 17 acres; homestead and paddock, 3½ acres; orchards, 7½ acres; land let off, 30 acres. Total, 160 acres.

The method of cultivation is to watch the weather carefully, in that wet renders the land too soft for working, and cultivation is pushed along with whenever possible. Great pains are taken to get a fine tilth, the land having a tendency to form clods if worked wet. Maize is planted at the intersection of squares, got by running furrows 4 feet apart crossways, and three corns are dropped at each point. Horse tillage is pursued till the plants grow too big, and then weeds are kept down by hand; cobs are pulled in May, husked in the barn, the cores and husks going for litter in the piggery and cow-yard. The stalks remain till the land is sufficiently dry to allow of the tillage for the next crop, when they are ploughed in. Maize has been grown continuously for thirty years. The usual yield is from 45 to 70 bushels per acre, on virgin land over 100 bushels may be got, and from 60 to 70 acres are planted annually, the total product being about 1,100 bushels. The varieties sown are from seed recently obtained from the Clarence, a few grains of "Golden Drop" and "Golden Dent" having been sent to Mr. Vicary, a neighbour. Two years ago Mr. Green sowed half a bushel of each, and from seed thus acclimatised the present crops are grown. The "Golden Drop" of last season, binned in the barn, presented a rich yellow transparent corn, whilst the "Golden Dent" was less so; both varieties yield equally well, and on good land choice acres were estimated at 100 bushels and 90 bushels respectively. Some corn is sold for seed locally, only, however, at current rates (3s. 6d. per bushel), and the farmers are much indebted to Messrs. Vicary and Green for obtaining so good types from a distance.

Oats for grain and hay occupy 23 acres, the cutting being done by a hired string binder. For both there is a good local demand, hay being sold up to 30 tons per annum, the rest is kept for home use, and chaffed by a neighbour at 10s. per ton. No advantage is gained by sowing oats early, the August planting giving the best returns of about 3 tons of hay to the acre, or 45 bushels of grain. This season White Tartarian from New Zealand were sown.

About 8 acres are this year in wheat—"Purple Straw"—from seed sent by the Department of Agriculture two years ago to Mr. Bridle, of Bumbowlee Plains, and purchased off him at 5s. per bushel. The flags at the time of my visit were luxuriant, rust not visible, heads not yet appearing, and a prospect of a yield up to 36 bushels per acre. Last year's sample in the barn, and about to be sold, presented a plump, starchy, dry, yet soft berry, much preferred by millers. "Purple straw" has, as yet, excelled all others grown in the Tumut district, and from its early maturity, escaping somewhat, if not wholly, the rust that is sure to attack late-sown wheat. There was a most instructive object lesson in progress at the time of my visit, twelve varieties of experimental wheat being grown side by side. A plot of "Jubilee" covering 192 square yards was sown with 4 lb. of seed got two years ago from a 2-oz. packet from the Department, and last year's yield was kept for this season's sowing. The flag was luxuriant, heads showing, no rust visible, and in height one-third more than "Purple Straw." "Trafalgar," sown from seed similarly obtained, had flags of a deeper green, equally tall, but less withery, and heads a week later. "Blount's Lambrigg," although sown one day later than the above, had a low creeping habit, with more withered flags, and only half the height. "Early Para" showed a good

clean flag, with heads just appearing, and a few inches shorter than "Trafalgar"; it had stooled well, although sown later—in the middle of June. "Victorian Defiance" presented a poor stool, narrow flag, of medium height, heads about to appear, although rather irregular; they were somewhat bearded, and the crop did not appear encouraging, but on good land the yield might be fair. "Ward's Prolific" was good looking, of a bright colour, fully flagged, but no heads, as yet, showing, being sown the third week in June. "Farmer's Friend," was less promising than the above, as was also "Smith's Nonpareil." "Summer Club" presented a narrow, pointed, upright flag, and although sown in May was very slow to start, yet had tillered well. "Leak's" was the finest wheat on the farm, and twice the height of the above, although sown the same week in May. "Early Para," however, excelled it in rapid maturing and luxuriance, since it was nearly equal in appearance, although sown a month later.

A paddock of 17 acres, previously cropped with maize, is now under grass, having been rested four years ago and since grazed. It will keep the six draught horses and two milch cows this coming summer. This is the land that is wet, and might be improved by drainage if neighbours would assist. Should the picking off the maize and oat stubbles be abundant, a beast or two will be purchased to fat and salt down for home use. Grass hay and silage are not made.

Manure is conserved for use on the orchard, and is made from horse, cow, and pig droppings, there being a good-sized heap recently got out from the piggeries.

The live stock number 17 horses, 2 cows, and 170 head of poultry. Several pigs are usually kept, but at the time of my visit the last had been sold, and the intention is to buy a pure-strain of Berkshire for breeding purposes. The horses comprise 8 active draught, 3 good saddle horses, one being of a handsome carriage type; a roadster filly, 2 years old; 2 farm colts, to be broken in during 1894; and 2 other colts the year after, displacing older ones that will be sold. There were also a good-looking pony for the children and a foal. The stallion "Hero," the father of the four farm colts, was the property of a neighbour, and his young 3-year-olds are worth £10 each, the price of horse stock being very low. Two milch cows are kept, both Durhams, of excellent type, purchased in the district three years ago for £13 the pair. Although the calf ran with one during the day, she gave 2¾ gallons of milk. Possibly no clover pasture could excel that of this farm for dairy purposes.

Mr. Green is a successful exhibitor of poultry, having won many prizes locally. The pure breeds are kept in separate compartments of a long, well-built poultry-house, and comprise Australian game, Partridge Cochin, White Brahma, Langshan, Orpington, Dorking, Leghorn, White Aylesbury ducks, and Guinea fowl. The strains have been acquired from noted breeders in Victoria and this Colony. In an isolated district fancy prices are not got, but for a setting of eggs 10s. may be paid. In reality, the neighbourhood has benefited through Mr. Green's enterprise. The breeding of pigeons for match purposes brings in 1s. apiece for the birds supplied. Several hives of bees are kept, and the honey, as well as the eggs, table fowls, and butter, are sold locally.

The vegetable garden is merely for house use, but so freely does every variety flourish, particularly onions, that pure seeds might with advantage be grown for the trade. There are 8 acres of orchard, including the old orchard of 1½ acres, the house orchard of 1½ acres, and the new orchard of 5 acres. The first-mentioned contains many notable trees, indicative of the suitability of the soil for the growth of fruit. An English walnut was 25 feet high. From

an apricot 25 feet high £7 was made last year by selling the fruit at 3d. per dozen. The pears from a tree 30 feet high, with a trunk 20 inches in diameter, sell at 6d. per dozen. An apple-tree 28 feet high bears enormous fruit, that measure 18 inches in circumference. These trees were purchased with the property seventeen years ago. About 1½ acres of reclaimed river-bed were planted three years ago with a varied selection of trees, some being got from growers at Wagga Wagga, others from Sydney. Four acres in 1892 and 1 acre in 1893 have also been planted, the land being choice flat alluvial. The trees throughout looked well, growing freely, with clean stems, and few indications of insect attack. There is a good sale of fruit locally, and the orchard adds from £40 to £50 per annum to the farm proceeds. Melons of many descriptions are also grown, as much as £20 in one season having been realised.

Book-keeping is quite elementary, a record of sales and purchases being kept.

The work of the farm is done by Mr. Green and his son, 18 years of age, the family helping in poultry keeping, preserving fruit for home use, and bees.

The subsidiary aids may be enumerated as follows:—Co-operative family labour; sales of seed corn, oats, and wheat, also eggs, table-birds, and pigeons; the use of home-cured bacon; home carpentry; bee-keeping; sales of fruit and melons. All repairs are done by tradespeople.

The points of interest are experiments in wheat culture, the use of seed maize acclimatised from the Clarence, the levelling and planting of the old river bed, extended orchard growth, and pure breeds of poultry.

The management, with a view to profit, is to make maize the main crop, to grow oats for grain or hay in next proportion, a minor crop of wheat is taken, and the orchard is a source of revenue. The vegetable garden, together with all the dairy produce, is for home use as well as home killed meat and bacon. The live stock comprise working horses, with the sale of one or so now and again, two cows for the home dairy, fat swine for sale or bacon curing, and choice poultry.

The farm is a flat alluvial seldom subject to flood, having a deep, friable soil that will produce large crops of maize and cereals, either for hay or grain; clovers grow luxuriantly; fruit trees do exceedingly well; and there is no fear of soil exhaustion. The ground has been reclaimed at no small labour from dense brush, carrying heavy timber, which has been utilised for fencing or stacked for fuel. The cultivation throughout is thorough, and the marketing is well done. The implements are suitable, and the string-binder and chaff-cutter of neighbours are hired in preference to ownership. The labour of the farm is that of Mr. Green and his son, with hired hands when required; and the area is a comparatively large one for so few persons to work. During the past year a great deal of time has been devoted to reclaiming the old river channel that was much overgrown with brush, planting an orchard, and lining roadways with greengages and preserving plums.

The turnover for the year may be taken at £400. The live and dead stock and improvements, house and farm buildings, may be valued at £1,060. The original outlay was £750, and the present value of the land may be regarded as about £2,240, so that the increase of £2,250 may be looked upon as representing the skill and labour of seventeen years of occupation, besides the whole of the household and personal expenses during that period. The soil and climate of the Tumut district are exceptionally good, and this farm shows what can be done with proper farming.

Michael Waters, Hawkesbury River, Richmond.

South Coast District.—Place, No. 9; points, 76·44 per cent.; arable, 80 acres; pasture, 14 acres; homestead, 4 acres; orchard, 2 acres; total, 100 acres.

(25 October, 1893.)

Mr. Waters has been connected with this farm for a long term of years, first as a farm servant to Mr. William Parnell, who then owned it, next as a lessee of 50 acres, and when in 1872 the estate was for sale, Mr. Waters, through timely financial assistance, was enabled to purchase the 50 acres for the sum of £950. The fences were useless, and a small orangery of good trees alone existed as an improvement, yet seasons were favourable and prices good, so that in a few years the debt on the farm was paid off. In 1878 an adjoining 50 acres were purchased, on terms, for £1,000, and now no money is owing. This farm of 100 acres abuts on the Hawkesbury, the river bottom being 45 feet below the plateau on which the homestead is erected, and the major part of the farm is 10 feet higher. In a great flood the backwater would cover the farm, but the main current would be at Windsor 4 miles distant, and since river banks are always the highest point in a wide valley, the homestead would be as it were an island. The town of Richmond is 2 miles distant, and to it and the railway there is a good road. The market for the produce is partially local and mainly the metropolis. The geological features are that the river silt has been chiefly derived from the Hawkesbury sandstones of the main mountain range, and where the heavier particles are deposited, sandy soils of the poorest description result, but the finer silt has formed the soil of Mr. Waters' farm, which occupies some of the very best Hawkesbury River land. It is porous and friable, of great depth, contains a fair proportion of organic matter, and is replenished from time to time by flood deposit.

Drainage is not necessary, although on one portion of the farm there is a lagoon and wet land supplied by soakage from the higher land on which the town of Richmond stands; but it is too valuable a pasture in dry summer time to be drained. Rain-water is conserved in tanks for household use. The fences are serviceable, the majority being 3-rail, some with 5-wire, and as timber is scarce, fences are made to last as long as they can, the divisional ones being of use to allow cattle to feed on the stubbles.

The residence is a comfortable six-room cottage of wood, standing in a neat garden with flowers and many shrubs. The farm buildings form a group by themselves, and were built by Mr. Waters and his sons, assisted by a carpenter. The hay-shed, of round saplings with iron roof, is 70 feet by 35 feet, and has partitioned off a buggy-house with fodder and chaff-room. The barn is of slabs, with iron roof, measuring 60 feet by 27 feet. The stable, 50 feet by 18 feet, is of slabs and saplings, with bark roof, and contains four stalls and two loose boxes. Another stable is 10 feet by 12 feet, also a cottage of wood and iron roof, 30 feet by 10 feet, with harness-room. The piggeries consist of a large pig-proof yard, with some roof shelter. These buildings are typical of the Hawkesbury, where not much shelter is needed for live stock, and may be taken to represent an outlay of £300.

The implements comprise five one-furrow iron ploughs (local make), three one-furrow "Deere" chill, one double mould-board by Howard; "Planet" horse-hoe, "Jersey" horse-hoe (Ames Co.), and an iron one of ordinary pattern made locally; two harrows with wood frames; two wooden rollers; iron horse-rake; "Farmer's Friend" corn-planter; corn-winnower, corn-sheller (Manners of Taree); horse-power (Richmond and Chandler), maize-

stalk chopper for use in the field (local make), "Paragon" mower (Hornsby), three drays with frames, spring cart, and buggy. Repairs and farriery are done by tradespeople. The "Deere" chill ploughs are highly approved, a single furrow drawn by two horses doing the work of a double furrow with three horses, and leaving an excellent tilth.

The system of farming pursued is to make maize the main crop, 50 acres being planted. Next in importance come hay crops, such as lucerne, wheat, and oats, 17 acres; pumpkins, 13 acres, besides where sown between the maize; potatoes, 1 acre; lagoon and pasture, 14 acres; homestead, orchard, vegetable garden, and yards, 5 acres; total, 100 acres. The chief market is the metropolis, and catch crops are got, if possible, such as turnips, green barley after hay, sorghum, and jam melons.

The ground is prepared for maize in June, when the stalks are chopped and ploughed in; a cross ploughing is made in September, furrows are struck 4 feet apart by Howard's double mould-board plough, and the corn is planted by the "Farmer's Friend." Pumpkins are planted between the maize in rows 16 feet apart, and spaced at 10 feet intervals. Horse and hand hoeing are pursued to keep down weeds. The cobs are gathered in March and husked in the barn, the husks being picked over by the live stock, and the cores serve for fuel.

The example set by the College Farm in drilling maize, so that the plants are equally spaced, at 16 inches' intervals, has been followed by Mr. Waters, and with satisfaction, since economy in labour is gained without loss of efficiency either in hoeing or yield. Hitherto, dropping seeds by hand at intersections 4 feet apart has been the Hawkesbury custom. Mr. Waters has also been the first farmer in the district to introduce a double mould-board plough in lieu of the usual two bouts of a single furrow, in order to mark out the rows, and a "Farmer's Friend" drill is used. The closing in of the open furrow and the hilling is accomplished by a horse-hoe fitted with side wings or mould-boards. One bushel of seed is used for from 4 to 5 acres.

The "Large Hawkesbury Yellow" corn is preferred, since the yield has measured 110 bushels, the return of the first prize acre for 1892, and the average is 80 bushels per acre. "Champion" and "Hogan's Red Spindle" are also approved varieties.

Lucerne is laid down for five years, and then five crops of maize are taken. The land is prepared by three ploughings, so as to get it particularly clean, and 15 lb. of seed per acre is sown broadcast either in March or September, a less quantity being considered unwise. No difficulty is experienced with dodder, since the seed is obtained from Mr. Richard's Bulga property, costing 1s. per lb. The first cutting is made when the lucerne is about to flower in about six week's time, and then two more, completing the first year; afterwards six cuts per annum are taken. The yield is 1 ton per cut per acre, or 6 tons per annum. The climate is very suitable for haymaking, and great pains are taken not to unduly injure the leaves by much turning. The cutting is done by the "Paragon" mower, the crop falling behind it and remaining untouched for a day, and the iron horse-rake is used to gather it into wind rows; next it is forked into heaps and stacked in the hay-shed, where it settles rapidly down and is trussed for sale. The bulk of the crop is sold chiefly in the neighbourhood, and a proportion is retained for home use. The return per acre may be taken at 6 tons, at £3 5s. = £19 10s. Oats are cut for hay by the "Paragon," being delivered into sheaf bundles, which are bound by straw bands, stacked for two days, and then carried to the hay-shed, the yield being 3 tons per acre, selling at £3 per ton—in all, £18 per acre.

Pumpkins are largely grown, the 13 acres being apportioned as follows:—pumpkins, 8 acres; jam melons, 2 acres; water melons, 1 acre; Royal pumpkins, 1 acre; cattle pumpkins, 1 acre, besides those grown between the maize. These crops make a quick return, for pumpkins sown in September are off in January, and green barley or wheat is immediately put in. All varieties sell readily. Last year 5 acres of pumpkins yielded 612 dozen, fetching from 4s. to 6s. per dozen, whilst the inferior ones were used at home for cattle and pigs. Water melons yield 40 dozen per acre, and fetch 5s. per dozen. Jam melons give 12 ton per acre, at £1 5s. per ton. Turnips are sometimes taken as a catch crop, yielding 5 tons to the acre, selling at £2 10s. per ton. Two crops of potatoes are got per annum, the first lot put in in September are off in December, and those planted in January are harvested in May and June, the yields being 6 tons per acre each, or 12 tons in all, selling at from £4 to £6 per ton. "Brownell's Beauty," "Skyblue Kidney," "Scotch Grey," "Dean," "Early Puritan," "Ruby Red," and "Satisfaction" are varieties grown. The double mould-board plough is used to open out the furrows in which the sets are planted.

No system of manuring is pursued, nor are fertilisers purchased. Stable manure with husks and cores are rotted in a small uncovered heap. The pig manure is collected from the large open yard. Maize-stalks are ploughed in. What a benefit manuring confers was to be seen in the lucerne paddock wherever droppings had stimulated a luxuriant growth.

Reference has already been made to the conservation of fodder crops. There is no systematic laying down of grasses and lucerne. The 14-acre pasture paddock with lagoon is used for the stock in summer, and its water couch-grass proves most serviceable, so that it would not be wise to drain the land.

The live-stock number 19 horses, 30 cattle, 6 swine, and 200 head of poultry.

Horse-breeding forms a feature of Mr. Waters' management, and adds considerably to the annual turn-over. The enterprise of the late Mr. Andrew Town in importing pure Clydesdale stock has been of the widest benefit. At first Mr. Waters secured good mares in foal to Town sires, and the produce has at all times fetched good prices, from 100 to 130 guineas being frequent figures. The two grand entires, "Prince Colin" and "Commodore," now on the farm have been bred by existing mares, and have won prizes at the Metropolitan and local shows, but times are bad financially when the service fee of such horses is lowered to £2 5s. The brood-mares are also high-class, and number seven, three being prize heavy draught, and four active farm mares. There are also four heavy draught geldings bred from the above, two fillies 2 years old, one colt of the same age, one colt 1 year old, all being Clydesdales, and one yearling blood colt. Two hackneys are kept for buggy and saddle, as well as a blood mare, "Hasty," a frequent prize winner, and now with a colt; in all, nineteen horses.

There are fourteen milch cattle, seven in milk and seven dry; they are of the usual Hawkesbury type; and surplus butter to the extent of £25 is sold yearly. The heifers number sixteen—in all, 30 head of cattle. Prize swine are kept, and at present five breeding sows of the improved Berkshire type derived from Town and Deane strains are installed, the boar of a neighbour, of New Zealand extraction, being availed of. Inferior maize and pumpkins form their principal food. Nine pigs, of from 150 to 200 lb., are killed annually, the greater part of the bacon being used at home, and dealers pick up about fifty suckers per annum at from 6s. to 7s. each when six weeks old; pigs bring in about £20 per annum. There was one store fattening in November.

Poultry are represented by Australian black and red game, 200 head being kept, realising by eggs and table birds £20 per annum. Mr. Waters' birds have been frequent prize-takers, lay well, and are very choice for the table.

The garden is for home use, a portion of a field near to the farm-buildings being used for the purpose. The orchard adjoins also the farm-buildings, and covers over an acre of ground, two-thirds being citrus and one-third mixed trees. The citrus trees are over 40 years of age and bear fairly well. The stone-fruits form also large trees of about nine years standing, but the orchard evidently does not receive the attention it deserves as to spraying and pruning.

Book-keeping is merely a record of sales and purchases, and the totals are available for several years past. The labour of the farm is accomplished by Mr. Waters, his two adult sons, and the co-operative aid of the family.

The subsidiary aids may be enumerated as co-operative family labour; sales of maize and potatoes for seed, pure Clydesdales, Berkshires, and game birds, sales of dairy produce, bacon, and poultry, also orchard fruits and hire of maize-chopper.

The points of interest are the keeping of pure horse, swine, and poultry stock. The large area under tillage worked by family labour. The introduction of maize planting in drills, and the use of a double mould-board plough.

In reviewing the management with a view to profit, the utmost appears to be won from a soil incapable of exhaustion, because floods renovate it from time to time. The maize crop yields extremely well, the lucerne hay is made as perfectly as can be, double crops of potatoes give 12 tons to the acre, and the various pumpkin crops fetch good prices in Sydney markets. The cultivation is, in all cases, carefully done, and weeds are kept under. Doubtless, were manure better made, and fertilisers purchased, even larger crops could be secured. The returns for the past thirteen years show admirable results, and the average of £658 per annum from 100-acre farm, of which 80 acres are under the plough, is made up as follows:—Maize, £250; hay, lucerne and oaten, £145; potatoes and pumpkins, £75; poultry and dairy, £75; pure-bred live-stock, £120—in all, £665. The capital invested may be arrived at by taking the actual purchase cost and an estimate of the property. The land cost £1,950, and £1,320 has been expended as follows:—homestead, £750; live-stock, £370; and implements, &c., £200—in all, £3,270. The present auction value of the farm may be put at £100 per acre, £4,000, which with £1,320 as shown above makes £5,320. If from this the purchase money, £1,950, be deducted, £3,370 represents the outcome of Mr. Waters' life-long farming, in addition to which there is the whole of the household and family expenses.

Edward Gibson, Fig Tree, Unanderra.

Place, No. 6; points, 78·94 per cent.; arable, 16½ acres; pasture, 76½ acres; homestead and paddocks, 9½ acres; orchard, ½ acre; total, 103 acres.

(31 October, 1893.)

Mr. Gibson arrived in 1858 from the north of Ireland, where he had experience as a boy on his father's farm. Possessing but little money, he obtained employment and experience for eighteen months on a dairy-farm in the Illawarra District. He then rented a small farm in the same district, and with financial help was able to stock it with dairy cattle, and in eight years' time sold off and realized £1,800 profit as a tenant farmer. He next purchased a property near Dapto, which, with all its stock, was handed over two and a half years ago to his two sons. The present Fig-tree farm was

bought five years ago, with a three years' lease to run out. Two years ago he built the present commodious residence and commenced dairy-farming, some lands adjacent being rented for running dry cows and springers. The farm entered for competition is 103 acres in extent, and of the choicest description. With the exception of a low hill, covering 10 acres, it is wholly an alluvial flat, bounded on three sides by the constantly flowing "American" Creek, and is scarcely ever subject to even a few hours' flood. The position is sheltered, save from strong westerly winds. By road the distance from Wollongong is 2 miles, and with the collieries near by constitutes the principal market. This local disposal is a particular feature of Mr. Gibson's profitable management. The sea is 2 miles away, the cliffs of the Illawarra Range are 2 miles further inland, and the Unanderra railway station is about 1½ miles away. The climate is typical of the Illawarra District, where the coastal ranges approaching so close to the sea precipitate in mists and dews the moisture of the ocean air. The alluvial soil is derived from the weathering of the coal-bearing rocks of the neighbourhood as well as various basaltic dykes, whereby it possesses great natural fertility. In depth it exceeds 15 feet of a friable, porous loam, supporting a rye-grass pasture of great luxuriance, and with a rank growth of clover, forming an ideal dairy-farm.

With the exception of one wet spot, draining has not been found necessary, but a ditch 6 feet deep in places has effected what was required to make good sound pasture. There is no need for conservation of water or of irrigation, but a large underground tank at the residence provides for household requirements, and there is also one at the dairy.

The fences are new, the external are of three rail, and the divisional of a top rail and five barb-wires. The pastures are divided into fourteen small paddocks, ranging from 2 to 12 acres, which the cattle take in daily rotation, camping at night on the hillside. There are six gates in all.

The homestead is of wood, built two years ago, containing ten rooms, fitted with every convenience, and standing in a pretty flower garden, central to the farm, and near by is the large vegetable garden and many fruit-trees, also a coach-house and stable. The farm steading is grouped about 200 yards distant, and consists of an old dwelling-house of slabs, lined throughout with match-boarding, and converted into an excellent dairy. This inner lining of match-boarding gives a spacious interior, kept spotlessly clean, and the large room is fitted with three tiers of stands for seventy-five tin pans. The windows are wire-lined, and a copious cross circulation of air is provided. The old kitchen fireplace is used to heat the cleansing water. Quite too close is the piggery, with paddocks and styes. The calf-pens have battened floors, which afford a very clean surface to lie on. There is a good-sized poultry-house, also a coach-house and stable, in which the implements are sheltered, and hay stored. The milking-shed is fitted with five bails, and has three large yards attached. Whitewash has been freely used, and the buildings as a whole present an unusually neat appearance.

The implements comprise two one-furrow ploughs, and an American one-furrow small plough, 1 iron horse-hoe and scarifier, set of four iron harrows, 1 pair medium, and 1 heavy wood harrow, wood roller, A.B.C. corn-sheller, corn mill (Richmond and Chandler), chaff-cutter (Bentall), mower (Hornsby), bullock dray, spring cart, buggy and sulky; also a large dairy plant. Repairs are done by tradesmen.

The rotation and system of cultivation is as follows:—The farm consists of 76½ acres of pasture, 16½ acres of arable land, a pig paddock of 8 acres, farm buildings, dairy, and residence, with orchard and garden, 2 acres, in all

103 acres. The $76\frac{1}{2}$ acres of pasture are divided into fourteen paddocks, and the $16\frac{1}{2}$ acres of arable into four fields, of which 2 acres are in lucerne, 10 acres in broadcast corn, 4 acres are planted with corn, and there is a half acre plot of potatoes. A small quantity of oats is grown for hay for use when the grass is too fresh, but very little dry fodder is required since the pastures never fail. The maize yields over 80 bushels per acre; lucerne gives six cuts per annum, potatoes do well, and some field peas are thrashed out for the poultry.

Beyond gathering the scrapings from the milking-yards, and keeping the fowl droppings for the garden, no manure is conserved, but on a dairy farm the animals fertilise the pastures direct, and where there is a large pig paddock, as is the case here, the same also occurs.

Very little fodder has need to be conserved on a purely pasture farm. The management of the grass land is very instructive, and Mr. Gibson lays down grasses successfully. When he commenced to farm this property two years ago, the pastures were in a neglected condition, being covered with tussocks of hard, unedible grass. To eradicate these, the lea was ploughed, and maize, sorghum, or planter's friend were sown in the furrows, and either cut green or let ripen. After this was sown, barley, together with from 2 to 3 bushels of rye grass, and 10 lb. of clover. On the barley dying out, the rye grass and clover will be found to occupy the ground. It is the opinion of Mr. Gibson that rye grass wears out in this district in ten years, wherefore he renovates his pastures by taking a maize crop cut green followed by the above mixture of barley and grasses. Great pains are exercised to get good rye grass seed, hitherto the supply has been derived from the Kangaroo Valley and Broughton Creek, but last year a Sydney firm supplied an extremely clean-looking sample, with the result that all the pasture derived from it developed a thick yellow rust, whereas the old pasture adjoining was wholly free. The same rust has apparently appeared in other districts this season, and it is usually the case that by inadvertent channels, pests are introduced. Great pains are taken to hoe out weeds and tussocks, the pastures being continually gone over, and the debris burnt, for, without doing so, the grazing value would be seriously diminished.

The livestock comprise 4 horses, 98 cattle, 11 sheep, 51 swine, and 300 head of poultry. There were 2 plough and 2 buggy horses, but several horses were running on the leased land. The cattle comprise 72 milkers, 12 yearlings, 13 calves, and 1 bull. Mr. Gibson's experience is instructive as to the effect of continued breeding from a cross in dairy cattle. When at Dapto his dairy herd was pure "Major" stock, celebrated for size and yield of milk, Durham being the dominant type. About six years ago the fashion set in for Ayrshires, and Mr. Gibson purchased full-blooded bulls at fancy prices. The first cross were full of vigour, and mostly bulls, but when the first cross heifers were put to an Ayrshire bull, the progeny was stunted, with small teats, and altogether inferior. Mr. Gibson has abolished the Ayrshire, and is determined to build up again a "Major" herd, and now uses one of his own home-reared bulls, three years old, called by him "Major II." He is of a light roan colour, of a kindly disposition, and with points that will please a dairyman. Already his influence is shown in a large fall of heifer calves, large, robust, and with good coats. The "Major" strain is scarce enough, that bull having died eleven years ago, but now that the Ayrshire fancy is over, Mr. Gibson considers that the good old Illawarra type, with dominant Durham influence, is likely to retain its reputation without any further crossing experiments. A ready sale is found for springers at up to £10 per head, and each year £120 is derived from this

source. The cattle in milk number 72. They show the Ayrshire cross plainly, also a Jersey touch here and there, indicated by the yellow skin. Owing to early precocity from rich pasture, together with the carelessness of neighbours with regard to their bulls, several of the heifers in milk are less than two years old, and in consequence are also stunted in their growth, but may fill out ere their second calf is born. There were two "Major" cows, mother and daughter, each of which yield 5 gallons of milk per day five months after calving. Work in the dairy commences at 4 a.m., and in one and three-quarter hours the 72 cows are finished, the family mustering 5 milkers, each stripping 10 cows per hour, with a boy to carry the buckets to the dairy. Into each milk-pan a spoonful of "thick" milk is placed prior to pouring in, with a view of ripening the cream with certainty. At 4 p.m. the evening milking commences. The introduction of the factory system has displaced a large number of hand dairies, but by careful management, as good, if not better, butter, may be made. The possible liability of the factory system to inferiority is due to inability to control care and cleanliness on the part of the supplier, both with regard to the quality of the stock, their health, feed, and surroundings, also the production of an unvaried quality of milk, all of which the one proprietor has at command. He sees that the milk is treated under the best circumstances, and that the dairy utensils and water are clean. Moreover, whereas factories are worked by men, in a hand dairy women superintend, and are probably more particularly neat, exact, and clean. There are other appendages of good management to a home dairy in the better utilisation of skim milk, bearing of calves, and fattening of swine. Altogether, Mr. Gibson's dairy affords a successful instance of an old-fashioned dairy holding its own. The milk sets in from 24 to 26 hours, but if the weather be hot, sufficient ferments are deposited from the air without the spoonful of thick milk being first put in the pan. Churning is done in an 80-lb. Kiama churn, the butter being washed in it with two waters, and is next lifted out to drain all night on a tray, where it is salted, and next morning worked on a Bradford's rotatory table, and finally packed for market. The butter had a rich, natural colour, with good grain and a delicate taste, and has a reputation for keeping a long time without turning. The present production is 330 lb. per week from 72 cows, many being heifers, with their first calf. The cows calve without attention, and no losses occur. The calves are taken away the second day, and thenceforward fed on "thick" milk, on which they thrive, and soon learn to feed on the rich pasture. The butter is purchased by one dealer, whose connection lies with the miners. He pays the top price for dairy butter in Sydney on the day of sale, and accounts are settled weekly.

There were were 51 swine at the time of my visit, consisting of 1 boar, 9 breeding sows of a Poland-Berkshire cross, 32 pigs two months old, and 9 fattening three months old. The intention is to get a pure Berkshire boar, and eliminate the Poland-China strain. The young pigs are purchased by dealers for the Sydney market, at an average of 12 per month. Several are fattened for bacon, chiefly for home use.

A small flock of Southdown sheep were kept, consisting of 1 ram, 4 ewes, and 6 lambs, of a pure type and splendid condition, with a tendency on these rich pastures of attaining a great size. Sheep are extremely scarce in Illawarra, and these Southdowns are merely a fancy flock.

Poultry add considerably to the annual turn over. Bronze-wing and ordinary turkeys are reared to the extent of fifty per annum, also geese and ducks, many prizes being taken at local shows for all classes of poultry. Representatives of the following pure breeds are kept:—Spanish, White

Leghorn, Black Leghorn, White Hamburgh, Game (Australian and Duckwing), and Plymouth Rocks. Thick milk is used as poultry food, and the fowls pick over the maize and oats, and run extensively over the farm, earning their own living without labour to the farmer.

Orchard fruit is sold, also surplus vegetables, the dealer taking what he wants, the kitchen garden being very productive and well attended.

Book-keeping is elementary, merely a record of sales and purchases being kept.

The labour of the farm is done by the family, the four daughters and son attending to the milking and dairy.

The subsidiary aids are:—Co-operative family labour; sales of springers, calves, pigs, and poultry; also orchard and garden produce.

The points of interest are:—Excellent pasture; the hoeing out of tussocks, and the mode of laying down grass; a pure dairy herd and Southdown sheep; the breeding of a large number of pigs; keeping of all varieties of poultry, many prizes being won; a model dairy on the hand system; marketing of produce to a dealer, who pays cash on the basis of Sydney prices.

The management, with a view to profit, is shown by the returns to be excellent. The farm is a freehold of 103 acres, costing, at £35 per acre. £3,605; the house, fencing, and improvements may be taken at £1,100, and the live stock at £900; in all, £5,605. The sales per annum are about £780, made up of—Dairy produce, £500; sales of cows and calves, £130; pigs, £100; poultry, £50; total, £780. In addition to which there are the household expenses of a family of seven persons. The management may be regarded as excellent, and the dairy a model one, on the old-fashioned system.

William Swan, The Meadows, Albion Park.

South Coast District.—Place, No. 10; points, 66·31 per cent.; arable, 35 acres; pasture, 124 acres; homestead, 1 acre; total, 160 acres.

(3 November, 1893.)

Mr. William Swan is a native of the Illawarra district, and has had a life-long experience in dairying. He is a tenant of the farm entered for competition, the first full term of three years having been completed, and one half of a second one has expired. This farm labours, therefore, under the disadvantage of a very short leasehold, without compensation for improvements. The rent is £2 per acre, paid half-yearly in advance, but as Mr. Swan added to the dwelling-house and put up divisional fencing, at a cost of £275, a rent of 50s. per acre in reality is arrived at. The land is the very pick of the famed Illawarra district, and is distant from Albion Park township about half-a-mile. It lies midway between the mountains and the ocean, each being $2\frac{1}{2}$ miles away. The Macquarie River bounds the property, winding for over a mile, and watering every paddock. At flood-time the land may be submerged in places for a few hours, but the waters drain off at once from this flat, alluvial farm. There is very little shelter for live stock, but they lie, during winter nights, on the deeply-excavated sandy banks of the river. Milk is the chief product of the farm. That of the morning is sent to Sydney, *via* the Fresh Food and Ice Company, and the neighbouring Albion Park Butter Factory takes the surplus Sunday and evening milk. Springers, calves, and fattened culls are sold at good prices locally, the latter being sought by the butchers. The climate is all that could be desired, spring and later frosts are exceptional, and a drought merely serves to check the luxuriance of the grass, so that much preserved fodder is

unnecessary, for cattle will not touch hay when they can get pasture. Before settlement, cedars formed the chief tree, and a dense, luxuriant brush occupied this fertile ground. The banks of the Macquarie are 15 feet in depth, and probably as many more before bed rock is reached, the soil being a deep, porous, chocolate loam, with a limited area of sand and clay. Drainage has been necessary where some surface soakage lay in a depression, and a wide open ditch, 60 chains in length, is a success. In another paddock some deep furrows have also proved effectual, and are all that a short lease would warrant. Rain-water is conserved for household use, whilst wells, 15 feet in depth, will strike water anywhere. The fences are serviceable, generally two-rail, with a barb wire in many instances, which cattle quite understand. There are thirteen paddocks, from 3 to 35 acres in extent, and are grazed in routine order. The farm is under-stocked, so that the grass is nowhere eaten bare, whilst weeds and tussocks are carefully hoed out. Couch grass forms a proportion of the pastures, and the cattle leave it when they can get sweet young grass, but it serves as a stand-by for winter. The bulk of the herbage is made up of rye grass, prairie, and white clover, all of which grow with great luxuriance.

The residence consists of a six-room wooden cottage, erected by Mr. Swan, and the original slab dwelling-house with kitchen. There is a small flower garden in front, and the pasture extends up to the other sides. The farm buildings are of wood, and comprise a three-stalled stable and barn, five milking bails with yards, and a neat refrigerator shed for the milk before despatch by rail, erected at Mr. Swan's cost, fitted with tanks and Lawrence's cooler. Should a larger barn be at any time needed, the landlord allows the use of one that stands by the fence line.

The implements consist of a one-furrow wood beam bullock plough, a one-furrow iron plough, iron horse-hoe and scarifier, a wood-framed one, wooden harrow, "Prince" corn-sheller, four-wheel truck for drawing timber and green stuff, spring cart, and buggy. The milk refrigerating plant, including dairy cans, cost £65. A mower and roller are borrowed when required. Repairs are done by tradesmen.

The system of cultivation and rotation is as follows:—On entry, five years ago, Mr. Swan commenced to renovate the pastures by ploughing in the lea and taking a crop of maize, planter's friend, or imphie. The stubble is then ploughed in, a seed bed prepared, and the following mixture sown broadcast in March or April:—Rye grass, 1 bushel; prairie grass, 1 bushel; white clover, 1 lb., and oats may or may not be sown as well. About August the stock feed off the first growth, principally the oats, and by spring the new turf is firmly established, the growth being so rapid, and the paddock is browsed in rotation with the others. The 35 acres of arable land are cropped as follows:—Planter's friend, 12 acres; imphie, 5 acres; maize, 7 acres; oaten hay, 4 acres; potatoes, ½ acre. A paddock of 6½ acres of green oats was fed off during last winter, and is now kept as summer herbage. The maize sown in the furrow is hoed by horse and hand, and husked in the field, yielding 75 bushels per acre. This season "Pig Tooth" corn was sown from seed got two years ago from Berry. In past years "Hogan" yielded well. Out of the 500 bushels expected from this 7 acres, 100 bushels will be kept for the poultry, and the rest sold locally at from 3s. 6d. to 4s. per bushel. "Brownell's Beauty" was the potato planted on the ½-acre plot. The haulm looked well, and all tubers over home requirements will be sold. "Planter's Friend" is held in high repute as a cleaning crop for couch grass on arable land, which is starved into weakness by its dense growth. The 12 acres about to be planted will be cut green in May and through the winter. Last

year £25 was realised from sales of imphie seed, the best heads alone being taken, and 40 bushels of 60 lb. each were secured, which sold at from 20s. to 23s. each. Grass seeds are thrashed in some years to the extent of 80 bushels, which, on sieving, separate into 20 bushels of rye grass, worth 4s. per bushel, and 60 bushels of prairie, worth 3s. 9d. per bushel.

No system of manuring is pursued, the milking yards are cleaned up each week, and the gathered dung is made into manure for application to the ploughed land.

Fodder is not conserved to any extent, since pasture never fails, and cattle will not eat hay if they can get grass. Doubtless if a long lease were granted more of this fertile ground could be ploughed, and a larger number of stock kept.

The system of laying down grasses, already noted, is excellent.

The live stock are as follows:—7 horses, 110 cattle, and 150 head of poultry. There are 2 plough horses, and 5 for saddle or buggy. The dairy cattle form the leading feature, in that a more level lot of beautiful cows with deep frames and big udders cannot be met with. Pure Durhams and the "Major" strain predominate; here and there an Ayrshire touch is noticeable, and perhaps a Jersey cross. Their excellent condition and deep milking were remarkable;—the result of exceptionally good pasture. The cows must milk well or they are culled to be sold fat. Old cows are not kept, and with a due proportion of heifers coming on the herd is composed of milkers in their prime. Data is, unfortunately, not available as to the annual yield of any one cow; such records should be kept by every dairyman; but the buying of milk on its fat value by the factories will, doubtless, lead to complete entries of yield and richness being made. Fat in milk is a regular factor, not dependent on food or health, but peculiar to the individual; and, as Mr. Swan remarks, "thick blood makes thick cream," whilst the skill of dairy farming is to cull at once the old and inferior and to keep the cattle in equal condition all the year round. Mr. Swan's herd has established a reputation, whilst the rich pastures sustain the cattle in prime condition, and, in fact, many more could find food. There are 53 cows in milk, 17 dry cows, 35 yearlings, 1 bull, and 4 working bullocks; total, 110. When opportunity offers and grass is abundant likely cattle are purchased cheap for fattening. The milking is so arranged as to be in time to cart the cans to the Albion Park factory, whose van collects in one load for the station the milk of many suppliers, charging 3d. per can of 11 gallons for the service. The milk goes to the Sydney depôt of the Fresh Food and Ice Co., a fixed price of 6d. per gallon being given, but the morning's milk only is taken for six days in the week, whilst the local factory separates the evening; Sunday milk and surplus milk, returning an average of from 3½d. to 4d. per gallon, in proportion to the butter sold. The skim milk is returned, which, on this farm, cannot be done without for feeding calves. Household butter is purchased from the factory, none being made at home. No swine were kept. Poultry number 150 head, and return £60 per annum for produce sold locally, 35 dozen of eggs being gathered weekly. They are well fed, a portion of the maize crop being retained for their use.

There is neither garden nor orchard, and in book-keeping, sales and purchases are entered. The labour of the farm is done by Mr. Swan and four boys, who take the milking.

Subsidiary aids may be enumerated as co-operative family labour, sales of grass and imphie seeds, good prices for high-class springers and fat cattle, and the dispcsal of eggs and table fowls.

The points of interest are a splendid herd, high-class dairy stock, the method of renovating pastures, open ditch drainage, the saving of grass and imphie seed, and the erection of buildings on a short tenancy lease.

The management, with a view to profit, is based upon keeping the highest class of milkers upon renovated pastures of great fertility, with co-operative family labour, and marketing the milk through the Fresh Food and Ice Co. and a local factory. The difficulties entailed by a short lease are many, for instance, deficient accommodation had to be met by the tenant building at his own cost; there is neither garden nor orchard, and the system of letting farms by tender leads to a rental being too frequently offered that can leave no profit. Mr. Swan's great skill is shown in the management of his cattle, but it would not be fair to him to publish the results. Suffice it to say that the annual turn-over leaves a fair return on the capital invested after the rent of £2 10s. per acre is deducted. The farm affords an instructive example of stock of the highest quality being carried on pastures of great fertility, the produce being most favourably marketed, and the whole worked with the minimum of labour.

Haywood Brothers, Oaklands, Pambula.

South Coast District.—Prize Farm; points, 88·31 per cent.; arable, 37½ acres; pasture, 71 acres; homestead, 7¼ acres; orchard, 2 acres; wattle, 30 acres; uncleared, 37 acres; total, 184¾ acres.

(14 November, 1893.)

"Oaklands" farm is less than a mile from Pambula township, and is distant 4 miles from the port of Merimbula, which is in steam communication with Sydney twice a week. The cultivated area of the farm occupies the alluvial flats of the Pambula River, which bounds the south side for a quarter of a mile. A portion is subject to flood, and it is exceptional if much damage results, whilst a useful deposit of silt would result. There are 68 acres of hillside, 30 acres of which, overgrown with wattle, are now undergoing clearing. Water never fails, although a dry year is felt by the herbage. The soil is extremely fertile, possessing somewhat the character of a black sandy loam of great depth, with a few wet spots, some of which have been drained on the underground system. The climate is tempered by proximity to the ocean, but is protected from its strong winds by an intervening range of low hills. In winter, however, cold winds sweep down from the Monaro table-land, and late frosts are common in spring, but do no serious harm. The geology of the district is not easy to decipher; there is a local sandstone, and the celebrated Pambula gold mines indicate a felsite, and even more complex formation, but as far as the farm is concerned, it is on a fertile alluvial flat. The property formed part of the original grant to Mr. W. Walker, then it became connected with Mr. James Manning, who was the immediate occupier prior to the late Mr. Haywood, who purchased it. This last-named gentleman died in 1889, and his three sons have since then undertaken the management. Each one supervises a different department, and their united intelligent labour accounts for so many subsidiary aids being successfully conducted, which have done so much towards winning the Champion Prize. The late Mr. Haywood first leased and then purchased the 184¾ acres in 1870. The price paid was £1,400, which included a costly residence, farm buildings, and cottages, so that a bargain was made. During his occupancy more buildings were erected, much land was cleared, and the fencing nearly wholly renewed. It is interesting to

note the magnificent oak-trees around the house, the flourishing mulberries, and Spanish walnut, also two large olive-trees, all of which serve to show how suitable the climate and soil are for their growth.

The land does not need much drainage. Some wet spots are sufficiently dried by open cuts, but others required timber and stone underground drains. Water conservation is not necessary, in that wells sunk anywhere afford an abundant supply. The fall of the river is such that water-power might be availed of at a moderate outlay, and the same race could be used to irrigate, save that the land seldom wants water.

The fences throughout are massive 4-rail, comparatively new, and in good order. There are five iron gates, twenty-eight other gates, and no slip-rails to the paddocks. Weeds are kept down along the fences. The paddocks vary in size from 2 to 27 acres, and are twelve in number.

The residence is of brick and stone, containing thirteen rooms, and was a very costly building, being erected by the Twofold Bay Pastoral Company, as one of their head stations. Behind it is the detached kitchen and offices. When occupied by the late Mr. James Manning, the gardens, in which he took great pride, were planted with many introduced trees. In front of the house there stand two olives 30 feet high, producing in abundance a small fruit, and one of the grand oak-trees has a trunk 5 feet in diameter, and last season's large crop of acorns of over 50 bushels was saved for the pigs. The farm buildings comprise a brick cottage, forming the dairy; a wooden barn, the upper portion of which is used as a fodder store, and implements are housed below, where also the food-preparing machinery is placed, and worked by an adjacent horse-gear. Another building contains a large bacon-smoking chamber, carpenter's shop, and forge. The piggeries comprise a range of styes having wood floors. A wood standing-floor is put on either side of the troughs, which are made out of hollowed trunks. There are four milking-bails, with exit doors at the head. The pig-killing yard is fitted with an overhead tram, on which a travelling hook runs, to which the carcass is suspended. The scalding tank is a 6 feet length of a boiler shell cut in half and forming a cheap tank such as no farm should be without. Into this tank the carcass is lowered, and is then carried in suspension to the cooling room. There is, furthermore, a buggy house, pig yard for fattening on separated milk, and a slaughter yard for oxen, also sundry poultry houses. The whole forms an extensive, complete, and serviceable farmyard kept in good order.

The implements are as follows:—One one-furrow (Hornsby), one one-furrow chilled digging plough (Howard), one two-furrow plough; two sets iron harrows; heavy triangular drag-harrow (home-made); disc harrow; "Planet" horse hoe; "Planet Jr." garden-sower; two horse-hoes and scarifiers; wooden roller; hay-rake (Howard); combined mower and reaper (Hornsby); cornstalk-rake (home-made); "Farmer's Friend" corn-drill; "Veteran" cornsheller and bagger; winnower (Hornsby); large chaff and bark cutter, by Locock and Barr, of Shrewsbury; horse-works; dairy complete with Laval's horizontal hand-separator and 80-lb. Kiama churn; honey and bee plant, including Cowan's "Rapid Reversible" extractor; two drays, spring-cart, buggy, and waggonette; also a complete smith's and carpenter's shop for doing all repairs at home.

The system of cultivation is to crop the arable land to the full. The 37½ acres are divided as follows:—Cereals—Maize, 19 acres; wheat, 2 acres; buckwheat, 1 acre; in all, 22 acres. Fodder crops—Oats, 2¾ acres; barley, 2 acres; vetches, ¾ acre; "Planter's Friend," 1½ acre; potatoes, 8½ acres; total, 37½ acres. The vegetable garden occupies 2 acres; orchard, 5 acres;

homestead, 2¼ acres; pasture land and swamp, 71 acres; wattle plantation 30 acres; uncleared land, 37 acres; total, 184¾ acres.

Land for maize is worked fine and clean before sowing; the corn is drilled by the "Farmer's Friend," which has a manure-box attached, and is kept clean by the "Planet" horsehoe, which also hills up; husking is done in the field; the cores are thrown as litter to the pigs or used as fuel, and the stalks are either ploughed in, using a disc coulter on the digging plough, or are carted to rot in a heap. The varieties sown were "Red Pip," "White Cardigan," which gives a most satisfactory yield, "Red Hogan," and a cross with it and the "White Hogan." In some cases maize is fed off by turning pigs in, but the local price of corn is now too good. The 19 acres should return close on 1,000 bushels, for the yield generally averages 50 bushels per acre. In past years maize from this farm was sold to Munn's Maizena Co., and the late Mr. Haywood obtained a certificate for maize at the Melbourne Centennial Exhibition of 1889.

Potatoes do remarkably well, and from their luxuriant foliage this season as much as 10 tons per acre may be got from the 8½ acres. Messrs. Haywood Brothers have initiated a novel method of planting, having noticed that if the sets be placed beneath the natural surface of the ground the land becomes hard, wherefore the rows are marked out and the sets are placed on the ground. Next, the "Planet" horsehoe, fitted with mould-boards, hills up and covers the potatoes. Later on, the first horse hoeing gives an additional hill up, which is repeated until the haulms are too high for further tillage. The "Planet" is used to throw out the potatoes, or they are forked by hand. The varieties planted were "Early Rose," from seed obtained from Geelong, and giving capital new potatoes twelve weeks after planting; "Brownell's Beauty," from local seed; and "Circular Head," from Hobart seed. All were doing well, the seed seldom missing.

There was an interesting experimental plot of wheat occupying 2 acres, which, on the date of my visit, showed no rust. A bearded wheat grew well on ½-acre plot, and will prove profitable for poultry feed. The seed was furnished by the Department of Agriculture, and was known as "Gallant's Hybrid," a prize-taker at the Inverell Show, and is said to be rust-resistant. There were 1½ acres sown with Leak's rust-resistant wheat, and smaller lots of a dozen other varieties.

Oats to the extent of 2¾ acres are grown for hay, yielding 3 tons per acre, and 2 acres of barley for green feed, timed to come in just before the winter, and to last right through. The wise provision is made of having a stack of hay always kept as a stand-by against scarcity of feed for the dairy herd. "Planter's Friend" gives the most luxuriant green feed for fattening pigs, and is used to supplement the separated milk; 1½ acres were planted with it. Barley and vetches sown together to the extent of ¾ acres are also used for the same purpose. In order to feed the poultry, a trial is being made this season of Japanese buckwheat, 1 acre being sown broadcast, and the plants were coming thickly up at the time of my visit. Frequently two crops are got off the same ground in one year; for instance, potatoes planted in November will be followed by swedes in March, or "Planter's Friend" in February by wheat which is harvested in December. No fixed rotation is pursued. Maize is the main crop. Land that has been cropped for years is laid down with grasses for a rest, being sown with a mixture of rye-grass, prairie, and cocksfoot. Numerous small breadths of paying crops are grown, and clean cultivation is the rule. The yields throughout are large—maize up to 70 bushels per acre, potatoes from 5 to 10 tons per acre, and oaten hay 3 tons per acre.

No system of manuring is pursued. The river overflows now and again, leaving a deposit, and maize-stalks are ploughed in or rotted for application to poorer land. Farm-yard manure is got from the sweepings of the stables, milking, pig, and slaughter yards. Poultry-droppings are put aside for special dressings, and in past years several hundred tons of lagoon mud have been applied to poor pasture. An experimental application of nitrate of soda to a row of potatoes on rich soil showed no advantage over unmanured.

Fodder is conserved for hay, 2¾ acres of oats and 2 acres of barley being grown. The crop is cut by the mower, and stacked in the farm-yard, close to where the chaff-cutter is placed, so that it may be readily chaffed by horse-power, a large proportion being sold locally. Ensilage has not as yet been tried, but Mr. Haywood is considering the matter.

The laying down of grass-land is carefully attended to, cleanness of the land being made a prime consideration. Maize is generally the prior crop, and a mixture of seeds is sown, consisting of rye-grass, prairie, and cocksfoot. These grasses grow quickly, and are soon established. An acre of cocksfoot has also been reserved for seed.

The live stock comprise 10 horses, 81 cattle, 25 swine, and 300 head of poultry. There are 2 plough-horses, one being a breeding mare, 2 coach-horses, one a breeding mare, 2 saddle-horses, and 4 young horses. All the animals were of a good type, the coaching-horses verging on a large size. Thirty cows are milked, besides which there are 10 springers, 30 young cattle, and 10 stores fattening; in all, 80 head. The dairy cattle are the usual South Coast type, with some Durham cows, the bull in use being a Devon, and the next sire is to be a Durham, so as to introduce a change of blood. The Devon bull was a very beautiful animal, typical of the breed, and quite worthy of admiration. His influence on the herd has been, without doubt, good in that the breed is noted for rich milk and great powers of keeping in condition, besides which it is now understood that the Ayrshire breed owed its origin to a cross between the Jersey and Devon. Heifer calves from good milkers are kept for the herd, and bull-calves are either sold for veal at eight weeks old, or are reared for three-year-old fat bullocks. The young and dry stock are run on neighbouring Government lands.

Sheep are bought for home use, chiefly cross-breeds from the Monaro tableland.

Pigs are bred for fattening and bacon-curing, for which the farm has a great reputation, the late Mr. Haywood gaining a certificate at the Melbourne International Exhibition of 1889, besides numerous prizes in this Colony. The improved Berkshire is kept, there being 5 breeding sows and 20 stores. The range of breeding-pens are well designed, being large, and floored with wood. The pigs do well on separated skim-milk, supplemented with green fodder, such as Planters' Friend or vetches, fed to them in the yard. Over 100 per annum are bred and fattened, and from 100 to 200 additional are purchased fat during winter, when the curing of bacon takes place. The H4 brand of bacon is well known in the market, and sells at a full price, 7d. per lb. being realised. The dry salt and sugar method is pursued, every care being taken to make a good article. The smoking chamber is very large, and the smoke is made from corn-cores, with sawdust or wood chips heaped on to smother the flames. Rolled bacon fetches 9d. per lb., and hams from 8d. to 9d. The fixing of a portion of an old steam-boiler as a scalding-tank has already been noticed. It is used also for boiling potatoes and all manner of vegetables. Pigs do well on boiled food, and a vessel of this description forms a very cheap and useful adjunct on a farm. Many thousand dozen of eggs are sent to Sydney, packed in patent

cases. Several breeds and crosses compose the bulk of the 300 birds that are kept. Leghorns are, however, cherished, because of their laying propensities, and Plymouth Rocks come next in favour. A few ducks and turkeys are kept, but no geese. Skim-milk is fed to the poultry, and special feed grains are grown, such as Cape barley, buckwheat, turnips, and mangold. The eggs from this farm fetch the highest price for South Coast eggs in the Sydney market, and the management aims at getting layers during January, February, and March.

Bee-keeping is made a special feature, there being thirty-three hives of Italian, hybrids, and English, occupying a large grass plot adjoining the residence, with provision for as many more hives. The boxes are made at home, and fitted with frames on the Langstroth system. Hoffman's self-spacing frames are highly approved of. The promise of honey this season is exceedingly good, and a ready sale is made locally. Full sheets of foundation are always used. Queens are raised at home, and a project is entertained of placing several pure nursery hives for queen-rearing on Montague Island, a few miles distant, where there would be no chance of intermixture with other bees.

When mining at Pambula was in full swing a year or so ago, there was a great demand for market garden produce, and milk was delivered twice daily. There is no such trade now, but 2 acres of good land are this season set apart and planted with all sorts of kitchen vegetables, for which there is a good local sale, besides numerous sorts for seeds, whilst some of the produce is used for the poultry.

In this garden the "Planet, jun." seeder is used. Amongst the sales of seeds made last year, sunflower fetched 7d. per lb.; buckwheat from 7s. to 12s. per bushel; planters' friend, parsley, mangold, turnips, melons, pumpkins, &c., also winter vetches, at 8s. per bushel; sorghum, 50 bushels, at 4d. per lb.; and potatoes. Nursery stock was also dealt in, over 2,000 fruit trees having been sold.

The original orchard has disappeared through age, but young trees have replaced the ancients, and, in some instances, vigorous trunks of useless varieties have been crown grafted with choice bearers; for instance, a Shropshire Damsel, which sheds its fruit each year, has been grafted with an Orleans plum; also the Five-crown Pippin in preference to other apples, since it does best at Pambula. The fruit is sold locally.

The dairy is furnished with a Laval horizontal hand separator, and the cream is churned in an 80-lb. Kiama. So successful is the result that Mr. Haywood intends to enlarge the plant, and drive it by power, whether steam or water has yet to be determined. The increased quantity of milk will be looked for from neighbours. The skim milk is given to the pigs and poultry, and is supplemented with green food, such as planter's friend, vetches, &c. When the Pambula mines were fully working a delivery of milk was made daily, at very profitable rates. This and the demand for vegetables swelled the annual turn over that year to £1,200. The butter is all sold locally at top Sydney rates.

The wattle grows to perfection in this district, and has spread over ringbarked hillsides. A contract has been let for clearing 30 acres of such country, £5 being paid in money, and the bark, the property of the contractors, to be carted free to Merimbula. The fallen timber is to be burnt off, and the stumps got out. This waste area under wattle has so grown into value as to pay for the cost of being made into good farming land.

The book-keeping is elementary, purchases and sales being entered. The labour of the farm is done by the three brothers and two hired men.

The subsidiary aids are co-operative labour, sales of seeds, both vegetable, grass, and farm, as well as nursery stock; also eggs and table fowls, dairy, fruit, and garden produce, sales of bark, bacon-curing, bee culture, hire of horses, implements, such as the corn-drill, the reaper at 6s. per acre (horses and labour being found as well), cutting bark for hire, letting out vehicles, home repairs (both smith and carpentry).

The general management, with a view to profit, is to utilise the local market and send all surplus produce to Sydney. Quality is aimed at, and, in consequence, dairy produce, butter, bacon, and eggs, fetch top prices. Numerous subsidiary aids swell the turn over. The land is carefully cropped, and the most made of it. The soil is fertile and well watered. Two crops and catch crops are taken whenever possible. The hand separator has been so successful that it is intended to replace it with a steam plant and purchase milk from neighbours. The largest turn over in any one year amounted to £1,200, which was made when the Pambula diggings were in full swing. Last year the total was £800. The original outlay in the purchase of this property was £1,400, but a large sum has been expended during the course of years in improvements.

Hugh McLachlan, Laurel Bank, Grafton.

North Coast District.—Place No. 5; points, 80·33 per cent.; arable, 26 acres; pasture, 30 acres; homestead, ¾ acre; orchard, ¼ acre; total, 37 acres.

(30 November, 1893.)

Mr. McLachlan purchased Laurel Bank in the year 1862, and has farmed and resided on it ever since. Until 27 years of age he had assisted his father, who was a practical Scotch farmer that had settled in the Grafton district in 1858, so that Mr. McLachlan learnt agriculture under one who had farmed in the old country. The land when first entered upon was a mass of dense scrub and timber, with about 30 acres cleared, abutting on a lagoon, and used now as pasture, because it is wet. Neither tree nor stump are to be seen anywhere on the 27 acres of arable land, and the soil may be ploughed 20 inches deep without meeting with a root. The price of land was higher thirty years ago than to-day, since it then cost £4 per acre of wet land and £22 10s. for the very best unimproved, whereas the present price would be about £20 per acre all round, including improvements, but this fall is due to the fear of floods. Last March the Grafton district was devastated with an inundation that overflowed all crops, leaving them a putrid mass of vegetation, and again in June the waters prevailed with a great destruction of live stock. The recuperative powers of the district are, however, wonderful, and there is now very little to show that ever such floods occurred. After twelve years of farming, an adjoining 171 acres were purchased out of profits derived from cultivating 27 acres, raising the total occupation to 228 acres, but this new portion was under lease to a tenant up to the end of last year, on expiry of which Mr. McLachlan determined to work the land himself. Since this competition was deferred from 1892, the prior entry of 57 acres has alone been judged, and allowance made for the extra live stock and implements.

The difficulties that confront the Clarence River farmer are many. The semi-tropical climate induces a most rapid growth of weeds, and is conducive to numerous insect and fungoid pests. The greatest drawback, however, is the liability to floods, but they are not an unmixed evil, in that the vast bulk is slowly moving water, depositing silt and renovating continuously cropped soils. The river is navigable for 60 miles to ocean steamers, and is 800

yards wide by Grafton, flowing between banks of alluvial soil exceeding 20 feet in depth. The waters are tidal, and great floods usually occur when with a heavy rainfall on the extensive water-shed there blows an inshore gale with heavy sea at the heads, keeping back the swollen waters. Much damage at these times is done by the slipping away of the banks, caused not so much by the scour of the river but by the overflow and swamp waters at the back standing at a higher level and percolating through into a falling stream. It is impossible for an individual farmer to drain such swamps on his own land, for the scheme would have to be an extensive one, and come under the control of a district board.

The soil at Laurel Bank is a fine, impalpable powder, without grit or stone, and at the highest point on the river bank is over 20 feet in depth. No soil can be easier to work, horses cannot poach it, and soon after wet implements can till it, yet heavy rains knock tiny clods into a hard, flat, tile-like surface. A horse-hoeing that has just thrown all weeds to the surface will be rendered useless by a passing thunder shower burying them again under this flat surface. The soil cannot be regarded as so very rich in itself. It is the vast bulk that constitutes its fertility, and this can be accounted for when it is considered that the greater part of the water-shed is granite country. The sudden rises of the river, when, without a drop of local rain; it is up 8 feet of a night, are due to the non-absorptive character of the granite mountain ranges, distant 60 miles inland, forming the water-shed, with the old silurian slates that are met with in the foothills, giving a tumbled country with many valleys, and towards the Upper Clarence sandstones overlying the coal. The weathered debris of these various rocks are carried towards the ocean, the coarser particles and sands being first deposited, and the finer silts finally form the rich soils of the lower reaches of the river. These Clarence soils may be depended on for two crops a year, and Sydney is the one market. Water carriage serves nearly every farm. Droughers can come alongside nearly every field, and from them transhipment is made to the ocean boat which reaches Sydney in thirty-two hours from Grafton. The small screw steamers that carry passengers create a short, sharp wash that does much to corrode the banks, especially where the protecting fringe of weeds has been injured by droughers, and to prevent this Mr. McLachlan has pitched his banks with 200 tons of stone. The facilities offered by water carriage enable the Grafton farmers to grow sugar-cane for the great mill down the river, and when ripe the company sends its own droughers and gang of cutters, paying 12s. per ton for the cane; and as 40 tons may be grown to the acre, a large profit is realised. The farmers on the lower river grow cane continuously for many years, despite the increasing sickness of the land, and no wonder then that rust, worms, and gumming compel resort to a rotation of crops. The growers on the Upper Clarence, not possessing such rich land, and only of late years recommencing cane culture, make sugar-cane an alternative crop with maize, and would probably take off one or two crops of potatoes before replanting cane. In any rotation a nitrogen gathering legume should occupy the leading place, but the difficulty to a Clarence farmer is to find for it a profitable use.* Perhaps to rest the land under rye grass and clover would be an excellent method were it not that risk of flood renders dairying too uncertain in that cows compelled to take refuge on distant ridges will be

* Cow-pea (*Vigna catiang*) has been recommended, sown at the rate of 5 lb. to the acre, and producing a yield of 30 bushels, or the weight of green fodder would be 10 tons in about four months' growth.

injured through neglect of milking. There are, however, several butter factories in the district.

On soils so porous there is no need for underground draining. Rain water is conserved in a cement tank for household use, and there are wells in two paddocks fitted with pumps. The fences were of two-rail, substantial, and kept in repair, there being a large supply at hand of posts and rails. Both gates and slip-rails are in use.

The homestead is on the bank and within a few yards of the edge, since the highest ground is by the river. The dwelling-house is of brick, and contains seven rooms, the kitchen and offices occupying the original slab cottage, which Mr. M'Lachlan built on his entry. There is a pretty flower-garden between the house and the water, and a good view is gained up and down the river. The warm climate calls for no extensive shelter for stock, so there are no stables proper, but the plough-horses are fed at midday in unroofed stalls, and green fodder is thrown into a long railed-off strip, 4 feet wide, between the ordinary fence and a low one, so as to prevent dirtying by trampling. The barn is of slabs, 36 feet by 20 feet, with a lean-to buggy-house at one end. The floor of the barn is on posts, and the rafter space is utilised for fodder storage. In the barn, potatoes and maize are prepared for market, the corn-sheller being driven by horse-power. There are three pig-styes near by, having sides of rails and palings, yards of earth, and sleeping-floors of wood, covered by a roof of iron. There is a cart-shed, and two unroofed milking-bails, whilst a separate slab shed serves for a carpenter's shop and smithy.

All implements are put under shelter as soon as done with. Those used for cultivation comprise two one-furrow, one two-furrow, two hilling, and a single-furrow gang plough, by Gilpin, an American model, costing £17, which does excellent work, particularly in covering in rubbish. The ordinary iron ploughs are of local make; and the double-furrow, by M'Diarmid and Scott, of Grafton, is highly spoken of. The hilling plough is fitted with handles that can be clamped at an angle so as to avoid damage to maize-plants when ploughing in close to a row. The roller and harrows are of wood, and of home make, also the A-shaped horse hoes and scarifiers, with short plough-handles. Mr. M'Lachlan has had a second A-frame added, giving more tines. To another, a strong horizontal knife, set to cut the whole width, takes the place of the the hindermost row of tines, but the tendency of the soil to a tile-like smoothness after rain prevents the extended use of an implement that is well designed to kill weeds. The "Planet Jr." horse-hoe is highly approved. The maize-stalk-chopper, by M'Diarmid, takes two horses to work, and consists of eight 40-inch knives, bolted to octagonal iron frames 20 inches in diameter. Its cost was £15. In the barn there are the chaff-cutter (Ashby), worked by the horse-gear (Picksley, Sims, & Co.), and the corn-sheller and bagger (Sim, of Morpeth), costing £15, and fitted with an elevator to deliver cobs to cart, bin, or upper floor; an addition suggested by Mr. M'Lachlan's brother, and not in common use. In order to protect seed-corn from weevil a zinc-lined case, holding two bags of maize, is fitted with a screw-fastened manhole for filling, and a 2-inch screwed plug for emptying, an arrangement that can easily be devised. There are the necessary appliances for a small dairy; small corn-cracker, corn-sheller, platform scales, wheelbarrow, horse-slide for green fodder, drill-marker, cart, buggy, and sulky. Light repairs are done at home, there being a forge and carpenter's shop.

The system of cultivation is to alternate maize with cane; a small area of potatoes are grown, also a little oaten hay for home use. Of the 27 acres under cultivation, 7 acres are in cane, 15½ acres in maize, 3 acres in potatoes

(to be followed at once by corn), half-acre in lucerne, and 1 acre occupied by the homestead. There are 30 acres of pasture, completing the total of 57 acres entered for competition. Particular care is taken to thoroughly clean the land prior to planting, three ploughings being preferred to scarifying afterwards, so as to bury the weeds, rather than risk a thunder-shower restarting them after being brought to the surface by the hoe. The cultivation of maize and cane has much in common. The corn is dropped by hand in a furrow, at 54-inch intervals. The cane sets are buried at the intersection of cross-furrows, the same distances apart. Both are frequently hoed, using the "Planet" or "A" scarifiers, and then chipping by hand. Hilling the corn is done by the single-furrow special plough already noticed. The varieties of maize sown are Hogan, Dent, and a large yellow corn, which is planted early in November, and ripens later than Hogan's. Blight is prevalent in the district, and some farmers who, after the flood, purchased seed-corn from Tumut were disappointed that change of seed from a colder climate did not obviate the liability to rust. But the cause probably lies nearer home. Fortunately, the corn on Laurel Bank farm was quite free from blight at the time of my visit. It was of a particularly luxuriant green, and some of it tasselling, promising a yield up (if rain fell when wanted) to 60 bushels per acre. The maize is husked in the barn, and the stalks chopped and ploughed in. After shelling and bagging, droughers approach the bank and convey the corn to the ocean steamer. Commission, freight to Sydney, and all charges are reckoned at 6d. per bushel.

Four varieties of cane are grown, the bulk being Mauritius ribbon, whilst Daniel Dupont, Singapore, and Fiji Rapphoe are being tried. Cane planted in September is cut first in from eighteen to twenty-four months' time. The yield is very weighty, from 40 tons per acre and upwards, the canes being cut below the lowest node, and topped below the nodes from whence the leaves spring, so that the pieces may be from 2 to 10 feet in length. The contract price is 12s. per ton, with an additional 1s. allowed, if carted to the river bank. Late frosts constitute a danger to all crops, in that a warm sun bursts the frost-bound tissues. The trash is, by careless farmers, burnt off the canes, but the Colonial Sugar Company insists on its being stripped by hand, and some farmers wisely burn it after the cane is cut, in order to destroy pests.

Potatoes do admirably on the Clarence, the first crop being planted in March, and harvested in July. The second one is put in during August, and lifted in November. The Sydney market is carefully watched, but it does not do to store potatoes in so warm a climate, and frequently the November crop grows in the ground, if digging be delayed. Should there be a glut in Sydney, the alternative is to feed the crop to pigs, rather than ship at a loss. Pumpkins are grown between the corn for home use.

Notwithstanding the silt deposits the Grafton soils can do with manure, and the local Ramornie Meat-works offers fertiliser cheap enough, because, unfortunately, there is no great demand. The alluvial farmers keep but few live-stock, and so make little farm-yard dung. Mr. M'Lachlan supplements what manure he can get from the piggeries with gatherings of rubbish and stalks, if the latter be not ploughed in.

A small quantity of fodder is needed for the live-stock, about an acre being cropped with oats for hay; they are cut by the scythe, and stored in a loft out of reach of floods. Grasses are not laid down, the water-couch coming up spontaneously on the 30 acres kept for pasture, because too wet for tillage. Buffalo-grass grows well, and couch forms the mainstay of the pasture where it is fairly dry.

The live-stock comprise 11 horses, 30 cattle, 2 swine, and 200 head of poultry. There are nine heavy draught horses of an excellent type of Clydesdale, these and the implements serving for the complete area of 228 acres. Mr. William Small, of Swan Creek, imported Clydesdales direct, and twenty years ago many of the late Andrew Town's stock were introduced to the Clarence, being purchased at full figures for breeding, but since New Zealand sent over so many good horses the prices have fallen, so that from £16 to £22 will purchase the best class. There are also a pair of buggy horses, of a small, useful, thick-set type.

The cattle number 30, and consist of 2 milch-cows for household use, 8 cows with calves running with them, 1 bull, and 19 steers, yearlings, &c., a few cattle being bred in order to utilise the feed on the wet pasture, and are sold fat.

Not many swine are kept, two pigs being killed annually for home use. The one breeding sow was Poland China. One store was fattening, and others are purchased, if need be, to use up the waste potatoes and inferior maize.

About 200 head of poultry, including some Muscovy and common ducks, are kept, and itinerant dealers barter goods for eggs, table-birds, butter, and other minor products. This method is pursued on all the North Coast rivers, and offers a very great convenience to the farmers. If, however, the balance be in favour of the producer at the end of the quarter, he gets no cash, but the credit is carried over, and a man with a large family can possibly keep pace with the barter. Now that butter-factories are being established, they might arrange to collect eggs and fowls and forward sizable lots to Sydney. If the birds were appraised at a moderate figure by the manager when sent in, they could then be sorted into prime, seconds, and inferior, and the credit balance on receipt of account sales for the month be divided *pro rata*.

A small patch in a field grows the vegetables needed for household use. In the small orchard near the house there were growing bananas, pineapples, citrus-trees, apples, pears, and quinces. Pines are not profitable, and the larger fruit-trees appeared to be suffering from root-decay, possibly an after-effect of the recent floods.

Bookkeeping is represented by entries of sales and purchases. The labour is compassed by Mr. M'Lachlan and his son. A hired man is kept for the new farm, and additional labour is got when required.

The subsidiary aids may be enumerated as co-operative family labour, sales of seed, corn, and sugar sets, light repairs, and the barter for household requisites of butter, eggs, and table-birds.

The points of interest were sugar-cane culture and growth of varieties of cane, excellent maize, thorough tilth and cleaning of the land, ease of shipment, good type of horse, and a commodious residence, and 171 acres of additional land paid for out of the profits of 27 acres of arable land.

The general management with a view to profit is based on maize, sugar-cane, and potatoes, grown with regard to thorough cleanness of the land. The labour-bill is kept down, while powerful horses and good implements enable the tillage to be well done. The marketing of the maize and potatoes is effected through agents, and a contract with the Colonial Sugar Company ensures a certain price for the cane over a term of years. The maize is grown from carefully-selected home-raised seed, so with the potatoes, and the culture of three varieties of cane other than Mauritius is experimental. Owing to so many successive floods and the loss of crops more or less, during the past five years, it was not possible to quote any figures representing the annual turnover of the farm.

Joseph Wass Johnson, Lowlands, Upper Southgate, Clarence River.

North Coast District.—Place, No. 4; points, 81·05 per cent.; arable, 40 acres; pasture, 12½ acres; homestead, ½ acre; total, 53 acres.

(1 December, 1893.)

This farm is situated on the banks of an arm, parallel with, and 200 yards distant from, the main stream of the Clarence. Shallow craft can navigate this creek, loading corn off the homestead, and in flood time it serves as a get away for the waters. It is, moreover, full of fish, and many a duck looses it head in the jaws of a giant eel, wherefore Muscovies, which care not for water are preferred. Public roads traverse the numerous high banks of the district leading to the farms, whose homesteads are generally next the stream, and in Mr. Johnson's case, the traffic is merely that of neighbours. Lowlands Farm is not naturally so fertile as others in the neighbourhood, but superior skill in cultivation is quickly seen. It was managed by Mr. Johnson when the property of his brother, until sold at a good figure to a gentleman, who put up superior buildings, a first-class residence, and made numerous improvements, including several acres of underground pipe-drains. Mr. J. W. Johnson still continued to manage, and on the death of the proprietor, obtained a lease. The property meantime was sold for £1,050, although its auction price a few years ago was £2,650, and large sums had since been spent on improvements, but this shrinkage was due to the fear of floods. This farm, therefore, occupies the position of a leasehold in the present competition. The soil is a deep, friable, sandy alluvial, subject to flood, the waters standing 5 feet over the highest spot, and necessitating arrangements being made for a speedy exit on the part of the occupier, who may find himself in the midst of a sea in a few hours, and have to swim his live stock for a mile to ground beyond flood level.

With water so plentiful, there is no need for its conservation, and stock are provided in the homestead with a large tank put in at the tenant's cost, and filled by a pump from the creek. When Mr. Johnson's brother had the property, he went in for cane, and drained, with 2-inch pipes 44 yards apart, 30 acres of wet land, only fit then for pasture, but now a fertile arable area. Surface drainage had also been attended to by running shallow ditches to enable rain-water to get quickly away. There were some rushes in the paddocks, but they were seeded by the floods.

The fences are substantial, and in good repair. In order to keep down weeds, a division fence between two fields of cane has, by consent of a neighbour, been taken down to their mutual benefit, since more ground is cropped, there being neither headlands nor weeds. One of the features of this farm is the eradication of standing weeds, and the destruction of seedlings by repeated horse-hoeing and scarifying.

The homestead is situated on the high bank of the creek, and consists of a superior weatherboard cottage, containing three rooms and dairy, with flower and fruit garden in front. A kitchen cottage of nearly equal size is at the back, and close by there is the bath and harness room. The coach-house is used as a store for new farm implements. There is a four-stall stable of slabs for the farm horses, and a detached two-bail milking-shed. The barn is particularly well built, and is also used for new farm implements. Mr. Johnson came from Lincolnshire some six years ago, and when in England was the winner of many ploughing matches. He was friendly with Cooke and Sons, plough makers, of Lincoln, and has represented them as an agent in the Grafton district. On the side of the farm-yard opposite the stables extends a long row of pigstyes, extremely neat and clean. There are eight styes fenced by palings, with a continuous iron roof, the yards and

sleeping floors being of wood slabs. Close to the piggery are a neat workshop and poultry-house, also a mid-day manger.

The implements are particularly good, those by Cooke predominating, and it is only by a wise selection that Mr. Johnson can till so large an area single handed. The double-furrow gang plough by Cooke costing £16, can complete 3 acres with three horses in a working day of eight hours, and this because the driver rides, whereby the horses are urged faster. When fitted with disc coulters it cuts up and buries the maize stalks effectively. Two of Cooke's single-furrow ploughs are also used, fitted with wood beams, disc coulters and digging mould-boards. To each of these, as well as to a double mould-board, can a "seed-sower" be attached at a cost of 15s., which Mr. Johnson considers is able to deal with maize with as much certainty as an American corn planter, besides saving an extra man and horse. Few farmers appear to recognise the value of a double mould-board plough. In Mr. Johnson's hands it plants cane and potatoes, making one traverse whereas a single furrow needs two. It can throw up a deep furrow in the centre of the rows of corn; take away the mould-boards, and place on a broad web-foot, and as a horse-hoe it cuts the weeds off perfectly. Replace the mould-boards with a potato body, and the tubers can be split out at a much less cost than by hand digging. The large 20-inch skeath or disc coulters fitted to Cooke's ploughs generally cut up maize stalks quite as well as a special chopper, drawn by a pair of horses. Cooke's chisel-tined iron drag harrows are an improvement on the wood-framed implements in general use. They can be worked in pairs, or singly by one horse, when the twelve chisel points do excellent scarifying between the rows of corn or cane, the handles being of assistance to free the tines from weeds. Cooke's expanding horse-hoe is of a better pattern than the A-shaped wooden ones, which do not open out, or the iron ones, made by many country smiths. It can be more widely expanded, has nine tines to which hoe-blades can be attached, so covering every inch of a 5-foot row. In comparison with the "Planet" horse-hoe, which Mr. Johnson works, it is twice the weight—160 lb.—and therefore does not jump about, nor does it skip the weeds. The other implements are a set of iron chisel tooth harrows by Page, of Bedford, wood harrows, wood roller, wheelbarrow, slide for green corn, platform, "Fairbank" scales and dray. In the barn there is a large maize-sheller, "The Farmer," which cleans and bags 60 bushels per hour, power being transmittted from horse-gear by Picksley, which also works a chaff-cutter and corn-cracker, both by Richmond and Chandler, as well as a circular-saw. Light repairs are done at home, there being a complete workshop. The necessary appliances for a small hand-dairy complete the list.

The principal crops are maize, cane, and potatoes, in the following proportions;—Cane, 11 acres; maize, 20 acres; potatoes, 4 acres; oats for fodder, 2 acres; barley, 1 acre; sorghum, ½ acre; water-melons, ½ acre; total, 40 acres arable; 12½ acres grass land; ½ acre homestead; in all, 53 acres. Maize and corn are tilled on similar lines as to preliminary cleanliness, and keeping down weeds during growth. The usual Clarence method of planting corn in rows 54 inches apart is pursued, but, with a view of getting more air and of scarifying four ways, Mr. Johnson has introduced the 42-inch square planting, dropping the seed by hand where the furrows intersect. Maize is husked in the barn, and taken by drougher to the Sydney steamer, freight costing 12s. per ton and other charges 8s., so that 20s. per ton is the full cost of marketing.

Cane is cut at a cost of 2s. per ton by hands employed by the grower, who personally sees that none is wasted, whereas the independence and

carelessness of the gangs sent by purchasing companies has been a frequent source of complaint in the past. Messrs. Boothy and Leeson, whose mill is adjacent to the farm, purchase the cane at 12s. per ton. In many cases, firing the cane to get rid of the trash is pursued, but buyers are getting more particular, and sellers find out that what they save in labour is lost in the lessened weight of cane cut. Twelve years ago numerous small mills studded the Clarence district, and of which only three are to-day in working order. All might have continued to make sugar at a profit, since the Customs duty of £5 per ton on imported sugar acts as a substantial bonus, and would have compensated for the less economical efficiency of a small mill. Like Messrs. Boothby and Leeson, all could have made sugar pay, but the growers were tempted to make contracts at higher prices, and one Company attracted all the cane to its mill. The farmers of the Upper Clarence are now growing cane more freely, and small mills get increased local support. The bulk of the cane grown is Rapphoe or Grey Fiji. The sets cost 10s. per ton, 14 cwt. suffice for an acre, and the distance apart is 5 feet. Mr. Johnson grows his own sets, and has extended the area under cane, being convinced of its profitableness. The young cane looked remarkably well, and the older fields promise a good cut. Though the plant was somewhat thin through not stooling, the foliage was of a dark, luxuriant green, indicating a yield, if the season continued favourable, of not less than 50 bushels per acre on land that is sandy. Pumpkins are sown through the maize at 15 feet intervals, and come in for pig food. A 2-acre plot of oats just harvested was at once put in with large, yellow Hogan corn, in two rows of 5 feet, and a row of pumpkins in the 10 feet interval, so as to get more ground and air, since it is not likely to be a heavy crop after oats. The variety of corn chiefly sown on this farm is Hallam's Flint, named after a farmer who fortunately had in his high ground 80 bushels of seed corn, which the flooded-out farmers of 1890 were glad to get at £1 per bag. The first crop was so good that Mr. Johnson has retained the seed.

Potatoes are an extremely profitable double crop of from 8 to 10 tons in the aggregate. The "Circular Heads," nearly ripe, were planted with winter seed grown on the farm, the product of some imported from Sydney during 1892. They showed plenty of haulm, and looked favourable, the misses being few, and tubers well shaped. "Early Vermont" were also clean and luxuriant. "Early Rose" is considered on the Clarence to be liable to blight, and is therefore discarded.

With a limited number of live stock kept in the open, there is scarcely any farm-yard manure to be made, but Mr. Johnson finds megas, to be had for the carting from the neighbouring sugar-mill, a useful application. During a recent flood a small island of it was stranded on the farm, and some applied to orange trees hitherto spare of bearing resulted in a golden yield. Cornstalks are ploughed in, for these sandy alluvials need decomposing organic matter.

The fodder crops looked well; oats yellow to nearly over ripeness for hay were judged to go 40 bushels per acre if cut for grain. An acre of lucerne was 22 inches high, ready for cutting, and sorghum, in a half-acre plot handy to the homestead, sown for summer feed, was coming up. The oaten hay is stacked in the farm-yard. No grasses are laid down; a natural growth of couch and water couch forming the pasture land, which is generally that part of a Clarence River farm too wet for cultivation. A few peas are grown for pig food.

The live stock number 6 horses, 10 cattle, 26 swine, and 149 head of poultry. There are 4 heavy draught horses of Clydesdale type, one mare

suckling a big three month foal by a Suffolk sire. Large-framed active horses are invaluable on a farm where labour is limited, and improved implements are relied on to get through a lot of work.

Mr. Johnson takes pride in a thoroughbred mare, with foal at foot, whose sire is Aberfoyle, one of the late Hon. James White's stud. The saddle horse is a well-bred thick-set animal that would take the fancy of anyone. The cattle number 10, and were of an ordinary mixed strain, 3 being milkers for home use, also 3 dry, 3 youngsters, and 1 steer. The calves are reared, and a big steer needed but a little extra feed to finish him for the butcher. The cattle are principally kept to feed down the pasture, but the profit is small, whereas the keeping of pigs is much more remunerative. The pigs number 2 boars, 4 breeding sows, 20 stores; in all, 26. Mr. Johnson prefers Poland-China, and his older boar is typical of the breed, being overhung with flesh. The breeding sows are not pure. Young pigs are sold locally or sent to Sydney. Some bacon is made at home. Clean-fed pigs make good bacon, and the surplus sells at 7d. and 8d. per lb., seven pigs having this year been cured. Treacle was in use for pig food, being purchased at 8s. 6d. per hogshead of 54 gallons, or about 25s. per ton, a price ridiculously low for so good a relish and feeding stuff.

The poultry comprise 100 head of various sorts, also 40 ducks, Muscovy being preferred, since they do not seek the creek, and so escape the danger of being eaten by eels. Eggs, table birds, and surplus butter are bartered for goods with itinerant dealers.

The garden and orchard are for home use. Book-keeping is represented by a record of purchases and sales. The labour of the farm is that of Mr. Johnson, with hired assistance at busy times.

The subsidiary aids may be ennumerated as co-operative family labour; sales of seed potatoes, dairy produce, bacon, eggs, and poultry; also light repairs.

The points of interest are excellent tillage, improved implements, the cultivation of tile-drained land, and a tenant farmer.

The general management, with a view to profit, is based on the growth of maize, cane, and potatoes, for which there are good markets. Mr. Johnson works the farm alone, hiring labour when necessary, and he is able to keep up a superior cultivation and thorough cleanliness by means of good implements and strong horses, well fed. The livestock are moderate in number. It may pay to rear a foal or two, but to breed cattle merely to eat down pasture is not very profitable at present prices. Farm-yard dung is scarce, and light soils doubly cropped need fertilisers. Megas may be got from the mill, and manure from the Ramornie Meat Works, but the need of some added fertiliser is evidently not fully recognised on the Clarence, reliance having hitherto been placed on silt deposed during floods, which gives an entirely new surface soil. Mr. Johnson is the tenant of a capital farm of 53 acres, let at £80 per annum, *e.g.*, 30s. per acre, on a lease of five years. Short leases discourage tenant farming, but Mr. Johnson has a good landlord. The turnover for the year cannot be easily got at, because of the floods, but from the data furnished it may be put down at the rate of £320 per annum.

David Doust, Bayham Farm, Clarence River, adjoining Brushgrove.

North Coast District.—Place, No. 7; points, 78·63 per cent.; arable, 51½ acres; pasture, 10 acres; homestead, ½ acre; forest, 118 acres; total, 180 acres.

(4 December, 1893.)

Mr. Doust's residence is pleasantly situated on a ridge above flood level, and commanding an extended view of the Clarence River. Grafton lies in

a direct line about 13 miles to the westward. The road on the river bank is, however, much longer, and small steamers stop to take up passengers by signal. To the south-east are prominent mountain headlands bordering the ocean, about 13 miles distant as the crow flies. Altogether the site is very charming, and from it an idea can be gained of the narrowness of the fringe of alluvial that borders the Upper Clarence, now one continuous field of waving corn. Let there but come a disastrous flood such as has been common to the last five years, a sea of water would prevail, leaving, on draining off, a mass of putrid vegetation and slushy mud. The pioneer settlers found a broad river hemmed in by high banks of most luxurious brush, sprinkled with giant timber quickly merging into a narrow forest of the heaviest gums, bloodwood, cedar, and mahogany fringing a marsh. In 1862 selection of these lands was rapidly made from Grafton downwards. Slab huts were put up on the high banks within a few yards of the main river, and the very laborious task of clearing the land was slowly proceeded with. Corn was the one product, and vessels lay alongside the homesteads loading produce for market. Mr. Doust was late in making his selection, and in 1866 could only get what others would not look at, by reason of the area being chiefly occupied by a lagoon. Out of the 180 acres taken up a great proportion was marsh and poor ridge land, covered with a forest of spotted gum, as it now is to-day. Thirty years ago the floods do not appear to have been so bad as of late; but fear of them led to a speedy removal of Mr. Doust's house on the river bank to a site on the main ridge. Prior to doing so it was necessary to make a wide corduroy road, 300 yards long—a work of great difficulty—across the marsh, and heavy trunks were therefore drawn from the forest. As time grew on the land was cleared, and to-day not a root can be met with. The problem of the marsh remained to be attacked until about eight years ago, when a contract was let to dig a ditch 12 feet wide by 4 feet deep and 46 chains in length. The mud was used to fill up hollows, and some 20 chains of narrower drains were cut, leading into the main one. The river bank was pierced by 6 chains of triangular-shaped box drains, having two outlets, forming a Y shape, and protected at their mouths by flood doors or flaps on hinges. Not only is Mr. Doust's portion of the marsh completely drained, but he has benefited his neighbour to an equal extent, so that, could the betterment principle have been applied, some of the £400 cost might have been shared. Several additional selections were made since the first, and the whole was worked as one farm. Now a great part of the original farm has been let off to Mr. Doust's sons, and the present occupation will probably soon be transferred to the eldest son. It may here be mentioned that the present competition, deferred from 1892 by reason of the floods, had been overlooked by Mr. Doust, who went in April last on a trip to England, and only returned in November. During the interval the farm had been worked short-handed by a son, so that the characteristic management was not continued. The farm, however, presents many interesting features, that of drainage, placing the homestead above flood level, and the subdivision of the original farm into many, leased by the sons.

The soil is a very deep, sandy alluvial, sloping from the main bank down to the drained lagoon. Water is conserved in a dam for the stock on the back forest ridge, and in underground tanks for household purposes. The boundary fence is partly four-wire, and substantial two-rail. The cultivation area has no divisional fences, not even with the son's land adjoining. The main road is the corduroy one already noticed. There are four gates, and, although white ants do damage, the fences were in good repair.

The homestead is on the ridge above flood-level, and was nearly wholly built by Mr. Doust and his sons, the former being a self-taught carpenter of no small skill. The residence is of weatherboard, containing six rooms, with kitchen and offices in the original slab cottage at the rear. Near by is the dairy, consisting of an inner structure beneath another roof supported independently on stout posts, whereby an even temperature is maintained, and the butter is kept in good order. The coach-house and poultry-house are also near. The farmsteading consists of a well-built barn of slabs and weatherboard, roofed with shingles, containing the corn-sheller driven by horse-gear. Adjoining are the harness shed, blacksmith's shop, two-stall stable, and stock-yards. Just prior to the floods of the last few years, Mr. Doust was opening up a trade with Sydney in lucerne hay, and specially constructed a large hay-shed 60 ft. x 40 ft., roofed with iron; it is now used for the storage of fodder crops. There are also a partly-roofed mid-day manger and piggeries with paling roofs and slab floors.

The implements comprise one two-furrow plough by Ritchie, which does excellent work, two one-furrow ploughs, by local makers, a set of iron harness (M'Diarmid of Grafton), wooden harrows, two A-shaped scarifiers, and a long-tined one to eradicate couch, all being home made; also, two wooden rollers; an American disc-harrow is much liked, and the "Planet" horse-hoe is in use. One of the first cane-choppers on the river was purchased by Mr. Doust, a machine made by Page, of Grafton, having 20-inch steel discs like coulters, but it does not such good work as one with knives. A horse-rake and a mower, both by Sim, of Morpeth; the latter had been in use for many years, and from its substantial make showed no sign of wear. The "Farmer's Friend" corn-planter; the "Veteran" sheller, for power, and a hand-sheller by Sim; power chaff-cutter, by Bentall; horse-gear, by Hunt; Avery's platform scales, blacksmith's and carpenter's shop, two carts, and two slides complete the list. The buggy was sold prior to the trip to England, and has not as yet been replaced.

The farm is cultivated as follows:—Maize, 45 acres; potatoes, 3 acres; pumpkins, 2 acres; melons, ½ acre; lucerne, 1 acre; total arable, 51½ acres; pasture, 10 acres; homestead, ½ acre; and forest, 118 acres; in all 180 acres. Maize is grown continuously, with smaller areas—3 to 5 acres—each year broken up for potatoes according as there is a demand. The earliest corn is an American sort, "Leaming's," got out by the Clarence P. and A. Society, and now extensively grown. Its stalk is short, free from blight, and ripens early. Small, medium, and large "Red Core" are also sown, ripening in the order stated. The cultivation is as follows:—All rubbish and stalks are gathered by the harrow and ploughed in. The land is well worked, with probably a second ploughing. Sowing takes place early in August and up to December, the corn ripening from January to May. The cobs are husked and cleaned in the barn. The corn is carted to the wharf and loaded on board the Sydney steamer, the freight being 1s. per bag of 4 bushels. The older lands yield 50 bushels, and those lately cleared up to 70 bushels per acre.

Two crops of potatoes are got yearly, the seed for the summer crop coming from Sydney, and then its sets do for the winter crop. "Circular Heads" are alone used. Mr. Doust brought out from England some choice potatoes gathered from various farms in Kent, where he saw large crops growing. They comprised "Early White," "Hampshire Kidney," "Tenner's Wonder," "Webber's Early White," "Beauty," and "Sutton's Abundance." Although planted late, it is to be hoped that they will become acclimatised and prove acceptable additions to the few varieties that have been run upon in this Colony.

Three kinds of watermelons are sown—"Cuban Queen," "Scaly Bark," and "Orange." The market is Sydney, but unless sent early the venture is scarcely profitable, what with freight 1s. 6d. per dozen, and the market fully supplied from districts nearer the metropolis. If sown in August, they become ripe in December, and realise 12s. per dozen, but if sent forward later only 3s. to 6s. is obtained. Cucumbers sent down in October fetch from 3s. to 6s. per dozen, but they have no such sale in December. In order to be early, sowing must take place in July in a seed bed, and transplanting in August, so as to be ready the first week in October. Pumpkins are sown throughout the corn for home use, and grama in odd corners, being good food for pigs. In 1889, 10 acres of lucerne were laid down for the Sydney market, but the floods of 1890 destroyed nearly all, and the large shed put up specially at a cost of £120 was rendered of but little service save to store oaten hay for home use. The 10 acres of pasture between the homestead and cultivated area are used for the horses, but land so rich would pay better if ploughed, Cane is now the second crop on the Clarence, and with a view to planting out several acres next season, some Rapphoe was being grown for sets.

No manure is purchased, and next to none made, for the live stock are seldom yarded. The land will profit by manure. The older lands show a lessened crop, whilst nothing can be done with the forest lands on this farm without a fertiliser. The time will surely come when those who own lands liable to flood will be glad to have some ridge country whereon to build and keep the live stock. As it now is, to own a dairy herd on the flats is to run the risk of a flood coming and the milkers being injured by enforced neglect, whereas, if fodder grown on the flats be fed to cattle on the ridges, dairying could be more generally pursued and the poor lands enriched.

Fodder is conserved for home use, such as oaten hay, and no grasses have been laid down, couch and water-couch forming the staple of the pasture.

The live stock number 12 horses, 7 cattle, 20 swine, and 30 head of poultry. The 8 heavy draught horses are good, useful animals; there are also 2 saddle horses, and 2 foals, one being an extremely pretty one about three months old. Two milkers were kept for home use, Mrs. Doust making excellent butter for a hot climate by the hand system; the surplus is sold to hawkers. The remaining 5 cattle of various ages are kept to eat down pasture. Mr. Doust is persuaded of the unprofitableness of raising cattle at present prices, but his farm is at present in a transition state. The pigs number 20, and comprise 4 breeding sows, 2 fat, 6 fatting, and 8 store. A large number of pigs are kept beyond the 4 breeding sows, and considering how the district is liable to flood, it is an open question whether a portion of the corn crop might not be fed to pigs, ensilage being availed of, which would neither float away nor be injured by immersion. Crops of corn destroyed season after season will ruin the strongest farmer, but silage is made before the flood season sets in. There is always a ready sale for bacon-pigs, and if a certain supply were available there would be encouragement for a local bacon factory, possibly on co-operative lines. Two pigs fed on lucerne and inferior corn were about 140 lb. each and ready for killing, and 6 others about three months old were making rapid progress. In past years many pigs per annum were cured, there being a good local demand for bacon from this farm. Hitherto poultry had been kept in large numbers, but "the disease," a species evidently of chicken cholera, in September last swept off the greater part. This plague is common in spring, and, doubtless, is communicated through food lying about and becoming contaminated.

There is a small kitchen garden and sixteen hives of bees, which with modern appliances would become a subsidiary aid of some value. During

summer much honey is usually made quickly, but this season it has not been so. No full books of accounts are kept; merely records of sales and purchases with the usual data with regard to the general work of the farm. The hay-shed occupies the site of the old orchard, of which only a few decayed trees remain.

The subsidiary aids may be enumerated as co-operative family labour, sales of bacon, butter, eggs, honey, poultry, and early vegetables, such as melons, cucumbers, also some lucerne hay. Building, implements, and repairs done at home.

The points of interest are drainage of a marsh, erection by own labour of the homestead, early vegetable and lucerne growing.

The general management with a view to profit is based on one crop, maize—sugar is about to be made a second. Very heavy work had been accomplished, at first in clearing and draining the land. Profits in the past have been good, and the tillage has been thoroughly done, maize being continuously grown, and the land replenished by silt after floods. The area selected, discarded by the early settlers, has been skilfully brought under cultivation, and the greater part is now let off to members of the family.

E. J. Dening, Roseville, Euroka, near Kempsey, Macleay River.

North Coast District.—Place, No. 3; points, 84·10 per cent.; arable, 19 acres; pasture, ½ acre; homestead and pig paddock, 2 acres; orchard, ½ acre; total, 22 acres.
(9 December, 1893.)

Mr. Dening has been for twenty-six years a resident of the Macleay, but is a native of the Colony, having been born in the Parramatta River district, and pursued the avocation of a market gardener at Five Dock, near Sydney, prior to his settlement on the Macleay. In 1869 he purchased Roseville, at a cost of about £12 per acre, in all £250 for 22 acres of really good land. Much labour was needed to bring the property into its present excellent state. The original brush had been exceedingly dense, with enormous timber, whilst the seller had only felled the trees, erected a small hut, and left a forest of big stumps. Now not a root remains, and the farm presents an object lesson both in neatness and in a use being found for every foot of ground. Mr. Dening lived on the farm till 1875, when he revisited Sydney, letting the land for five years. These 22 acres, cultivated with the skill of a market gardener, have chiefly assisted—a second farm, 2 miles off, having been rented from 1880 to 1886—to build up a substantial homestead in 1887, and keep a family of ten in a superior manner. The distance from Kempsey is 3 miles, but the broad Macleay intervenes, and has to be crossed by the punt. Hawkers call frequently, and pay cash for the products of the farm, Mr. Dening preferring to work through them than distribute himself.

The residence stands above flood-level on a gravel ridge overlooking the farm. The Macleay, when in a great flood, rises in places over 60 feet, and a wide extent of country is overflowed, including the farm in question. Euroka Creek is a narrow stream, between deep banks of silt, perhaps over 30 feet, intersecting the farm, and is crossed by a good bridge on a main road, which bounds the property. The only pasture on the farm is half-an-acre, comprising the sloping banks of the creek, and serving as a run for the live stock. These banks show a great depth of fine silt, the basis of a splendid soil, in which the deep roots of lucerne revel. The present crop of maize is most promising, and only needs some rain to bring it to perfection. The expectation of a flood clouds the horizon of an alluvial farmer, since he may see the fairest prospects ruined within two days, but these farms, however, yield most profit when drought prevails elsewhere, and, as a class, the

farmers of the Macleay have done excellently well. There is no reason why sugar-cane may not succeed. Many years ago its cultivation was taken up with enthusiasm, but, unhappily, a most unusual frost occurred during the first season, destroying the crop, and inducing the mill proprietors to remove at once the machinery to the Clarence.

The soil is so porous as not to need drainage, but Mr. Dening, in conjunction with a neighbour, has, by means of a 12-inch square wooden box-drain, with its outlet inserted 20 feet deep in the bank of the creek, drawn off the soakage from several acres of lagoon, and the whole could have been drained dry, but that the neighbour preferred to have some water. In two years the entire cost was recouped by the luxuriant crops of maize taken off hitherto useless soil. Rain-water is conserved for household use in a cemented tank, placed cleverly beneath a verandah of the residence, and a good force-pump, with hose attached, commands the flower garden, in which Mr. Dening shows much skill as a florist. The live stock have access to the creek by a narrow lane, and, as a large number of pigs are kept, they thereby water themselves.

The fences are two and three rail, and suffered much damage in the July flood through solid banks of small *débris* being entangled, and as the current was strong no fence could withstand. Those with wire fortunately remained intact as they fell, otherwise posts and rails were widely dispersed. The attention now paid by Mr. Dening to pig feeding arose from a suggestion made by Mr. Despeissis, when recently acting as a judge of farms, and the enterprise has been thoroughly gone into, provision being made for a large number, and paddocks over 2 acres in extent rendered pig-proof. The flood of last July swept away all the planted supplies of food for pig keeping for this season, and in consequence there are now the 5 breeding sows and only a few stores. One feature about the headlands of the maize crop deserves attention, in that stock press in on and damage the rails to get at the green plants, so that it is customary to keep the crop back 6 feet, leaving long strips of ground frequently given up to weeds. Land is, however, too valuable to be so wasted, wherefore Mr. Dening had plantations of arrowroot, but of which the flood has left only one plant. Stock, fortunately, will not touch the leaves, which shield the maize, whilst pigs do well on the tubes and stems. This season some oats are growing on these strips of land for hay or soiling, the live stock being fed with green food, cut by hand and entailing some labour, but yielding much manure.

This little farm, of 22 acres, possesses a superior residence of eleven rooms, in the erection of which Mr. Dening largely assisted, and the cost may be taken as £600. The design was one of a series published several years ago in the *Sydney Mail*, and when seen as a reality possesses great merit. The house is pleasantly situated in a large flower garden with several rows of good-sized fruit-trees on either side. The farm buildings were entirely put up by Mr. Dening during the two years immediately following the building of the house, and deserve notice for their neatness. The roofs throughout are of iron. The barn measures 40 ft. x 18 ft., the hay barn 30 ft. x 13 ft. A range of buildings under one roof comprises the buggy-house, workshop, cart-shed, 2 milking bails, 2 stalls for plough horses, and 2 for buggy horses. The milking yard is partially paved with slabs—an excellent idea, and over it generally the manure is made by trampling cores, waste green food, and litter, the pigs having free access to rout all about. The surface exposed to rain is too extensive for economy, and it would be difficult to keep fermentation going in dry weather. There are separate piggeries, providing for 200 head, with many pig-proof yards. The list of buildings is

completed by a fuel house, where cores are kept for household use. The area covered by the farm buildings is ½ acre, and another ½ acre for the house and garden.

The collection of implements is of some interest in that American ploughs have a reputation on the Macleay, high approval being given to the chilled digging mouldboard throwing up a shattered tilth with its wide deep furrow. The Moline Co.'s "Scotch Clipper" is Mr. Dening's favourite plough of this description, and he points out that its arched beam permits the use of a disc coulter 20 inches in diameter, which rubbish will not clog. For planting corn, Howard's single furrow, with the ordinary mouldboard is used. A one-furrow American digging plough with a wood beam is used for hilling maize. Mr. Dening makes the woodwork of his implements, such as harrows, A-shaped horse hoes and scarifiers, duck-foot expanding cultivator, rollers, and the corn coverer. This latter is somewhat of a novelty, and consists merely of a 10-inch plank, 4 feet long, with a pair of short handles, plough-like, and two pairs of iron tines 10 inches long, and set widening outwards. By its means the covering in of the seed, which is dropped by hand, is effectively done. An American 7-feet disc harrow makes good work. The barn implements comprise a corn-sheller, by Sim; a corn-cracker, by the Ames Co.; a chaff-cutter, by Hudson Brothers; and a wire sieve for screening maize; also, a cart, buggy, sack truck, slide, carpenter's tools, and appliances for a small hand dairy.

On a purely alluvial soil of so great depth a rotation is not deemed necessary, for floods replenish with silt, though they at times deposit barren sand, or even take away the useful surface soil. Maize is the chief crop, and occupies 19 acres. Around the headlands strips of oats are grown, and ¼ acre just cleared of oats for hay is about to be put in with sorghum and imphie, to cut for green feed in June. Pumpkins are planted throughout the maize, which, after being quartered, are sliced in the chaff-cutter, and used for all stock. Oats sown in May are cut for green feed late in November. Imphie and sorghum sown after oats in December are cut in June. "Rio" pumpkins also put in after oats in December are used for feed in the winter months, lasting from May to August. Tares and oats are sown in February for early spring feed about September. Barley sown in April is available for late spring feed about October, or a portion is made into hay in October. Lucerne is cut every four weeks through early summer, and every six weeks during the last of the summer, so that it is available particularly from November to March, and only yields no feed during the three months of midwinter—June to August.

To put the above into tabular form a clearer view will be got of the scheme of feeding:—Winter, three months, June to August: Imphie, sorghum, pumpkins, oaten hay. Spring, three months, September to November: Early tares, late barley, oats. Summer, three months, December to February: Lucerne, inferior maize, as green food. Autumn, three months, March to May: Live stock on the stubbles.

The breadths under potatoes, melons, pumpkins, herbs, sugar-beet, mangold, and arrowroot are small, but serve to supply hawkers, and the surplus is used for the stock. The cultivation of the maize is as follows:—The seed-bed is carefully prepared. This year the eradication of nut-grass, left by the flood, necessitated extra labour to the extent of £7 12s., for to have left it untouched would have made it a permanent weed. A second ploughing to bury weeds is preferred to scarifying, the digging breast being used instead of the ordinary mould-board. The latter is employed to make the furrows 45 inches apart, in which the seed is dropped. Weeds are

rigorously kept under, but when tasselling occurs they must needs be left untouched in the corn, and have three months before them undisturbed, which gives a growth of 4 feet high in this rich soil. Hilling is done by the wide central furrow of a Moline plough. The cobs are husked in the barn, the cores are used for fuel, and the husks for feed. The only variety of corn sown is "Golden Beauty," obtained from seed introduced two years ago from Queensland, and highly thought of by reason of its good yield, low stalks, heavy corn, and the good price realised. The growing crop was all that could be desired; tall, few misses, clean, with caterpillars and blight scarce, promising cobs, and luxuriant foliage. Mr. Dening regularly goes through the growing maize to cut out as green feed all inferior and diseased plants.

The potato crop was a promising one of "Peach Blossom," from seed obtained three years ago; some supposed "Brownell's Beauty" were also growing from seed got this year from Sydney, but they were probably "Circular Heads" misnamed. Hawkers buy what they want, and the surplus is used for pig food. The flood destroyed nearly all the lucerne, but that remaining was laid down three years ago, and now yields a beautiful cut. At first a few spots of dodder or "ring-worm" were observed, but by cutting them out and sprinkling the ground with boiling water the parasite was destroyed, and no harm done the lucerne by the remedy. The July flood destroyed all the small areas of Swede turnips, sugar-beet, mangolds, and arrowroot that were relied on for pig food.

The making of manure has already been noticed. Stalks are ploughed in. Fertilisers are not purchased. There are in the neighbourhood deposits of marble, beds of oyster shells, and caves of bats' dung, but these sources of fertilisers do not appear to have been exploited. The limestone can be easily put on board vessels, and is a deposit that might be cheaply availed of for agricultural purposes generally.

The conservation of fodder is represented by oaten hay, stored in the hay barn, but green fodder is the interesting feature of this farm, Mr. Dening having proved it to be a profitable source of revenue. He is, moreover, impressed with the need of making a provision of food against floods, lest the live-stock be again sold off because of starvation. Ensilage lends itself to this purpose, and may probably be employed.

The live-stock carried by this farm of 22 acres comprise 4 horses, 12 cattle, 62 swine, and 130 head of poultry. The two plough horses are aged, but do their work, and the two light horses serve for buggy and general purposes. None are bred. Six cows are in milk, no bull is kept, and calves have been reared in the past until there are now too many cattle. The surplus hand-made butter is sold locally at good prices, fetching from 8d. to 1s. per lb. The swine number 1 boar, 5 breeding sows, 10 fattening, 3 months old, 40 stores, and a litter of 6; in all, 62. Two hundred head of swine would have been kept had not the flood destroyed the provision of food, but since July 110 have been sold, and to economise food the sows have missed a litter. A boar and sow of pure Berkshire type are kept, the other four sows being of a mixed type. One is a noted mother, having reared thirty-three pigs in three litters within twelve months. Ten three-months-old pigs were fattening, and these, besides forty stores, together with a week-old litter of six. It was intended at first to make bacon largely, but it was speedily found to be more profitable to sell live pigs in the Sydney market. Twenty-three pigs have been cured this year, a portion for home use, and local storekeepers buy bacon at 5½d. per lb., but the barter system does not tend to develop an industry. The poultry were of various breeds, and dealers take away both

eggs and table birds. A plot in a field near the house is set apart for vegetables for sale if asked for. "Ice cream" melons sell freely to hawkers at 8s. per dozen, and had it not been for the flood half an acre would have been cropped. A recent hailstorm injured the orchard; the principal trees have been grown from cuttings, taken because Mr. Dening fancied the originals. Many have made capital growth, with clean bark and few pests, but the apples suffer from a borer beetle.

The bookkeeping showed all the purchases and sales, but no balance-sheet could be made out. The labour is that of two adults, Mr. Dening and his son, assisted by the co-operation of the family. The floods this year necessitated extra labour in putting the fences right and digging out nut-grass. The turn over in 1892 was £184 from 22 acres.

The subsidiary aids are co-operative family labour, home building and repairs, implements made, bacon-curing, sales of vegetables, fruit, melons, butter, eggs, poultry.

The points of interest may be enumerated as a small area of rich land wholly under the plough, a large number of live-stock fed by soiling, pig-breeding on a large scale, local sales of produce to hawkers for cash or barter; land drained, good implements used, headlands cropped, weeds kept under, and a superior homestead built.

The management with a view to profit was good, every little help being used to swell the turn-over. The cropping was more that of a market garden, and everything was done well. This farm gives an indication of how much may be produced from a small area of really good soil, and the comfortable residence affords a proof of the profits that have been realised. Particular mention must be made of the extended breeding of pigs, as showing the true lines for an alluvial farmer to go upon, and the loss of food by the flood indicates how valuable ensilage would prove itself to be.

Bernard Muscio, Purfleet, Taree, Manning River.

North Coast District.—Place, No. 2; points, 86·42 per cent.; arable, 31½ acres; pasture, 13 acres; homestead, ½ acre; orchard, 5 acres; total, 50 acres.
(14 December, 1893.)

In 1857 Mr. Muscio left his native canton of Ticino, in Italian Switzerland, to join his brother in New South Wales. He was then 16 years of age, and had worked on his father's small Alpine farm. The Manning River was his destination, and he stayed three years with his brother. After six months spent in gold-digging, he and his brother rented 16 acres of alluvial land at Taree. The owner was at a feud with his neighbours, and they visited their uncongeniality upon the hard-working tenants by refusing them access by road to the wharf, so that in order to ship their corn the brothers had to perilously carry the bags on their backs across a narrow log spanning the creek. Under such circumstances they abandoned the lease in 1861, and bought good land on the Hastings at £4 10s. per acre. The Manning, however, retained its attraction, and in 1879, the brothers bought adjoining farms at Taree, paying £24 10s. per acre, *e.g.*, the 50 acres entered for competition cost £1,225. The land was first rate, but its condition deplorable, giant stumps abounded, fences were decayed, the slab hut and barn scarcely better, and the land was ruined by weeds. The labour of Mr. Muscio, single-handed, has changed all this, and both residence and homestead have been built by him with the assistance of a few days' hired labour to fix the roof. In 1882–3 it was difficult to get good building timber on the Manning, and much additional labour was expended in trimming and straightening boards, so that the cost was about £450.

Maize has been throughout the main crop of the farm, whose area of 50 acres is nearly too great a task for one man to cultivate. The farm is got at by boat crossing the broad tidal waters of the Manning. Taree lies on the opposite bank, 800 yards distant, and droughers load corn at the barn, where the banks are 25 feet high. Floods are, however, seldom bank high, and not a great one has been experienced since the erection of the house, which stands next the stream. The first maize paddock dips to some partially-drained grass land, whereon the stock run. Then there is a rise, and the second maize paddock slopes gently down to a creek crossed by a 50-ft. bridge, erected with neighbours at a cost of £20, and on the other side of which the farm is continued. The soil throughout is a deep, porous, sandy alluvial silt, capable of continuously bearing maize, but its fertility lies in its depth, for when maize followed potatoes there was only half a crop, showing exhaustion of the upper layers. The climate is moist, like that of the northern rivers generally, so as to render fungoid pests a source of trouble, and for this reason vine-culture languishes.

The 6 acres of wet grass-land was once a lagoon that has been drained by four neighbours uniting to make a deep cut 8 chains in length, and Mr. Muscio has also run a cross drain 4 chains long. His experience of co-operation in agriculture is that he may clean the deep ditch as often as he likes with no one to help, and the labour of throwing dirt up 10 feet is too much for one man. Had timber been cheap, it would far better have been a triangular underground drain, pipes being out of the question, but all timber has long ago been cleared from the alluvial flats of the Manning. Rain-water is conserved in iron tanks for household use, and in the grass-paddocks there are shallow sinkings, that are slabbed so as to enable stock to drink.

The fences are substantial two and three rail, in good order, and free from weeds. There are several gates, and those on a Government road dividing the farms have been designed and put up by Mr. Muscio; one gate in particular has a double swing for shutting one of two grazing-paddocks off to live-stock.

The residence of weatherboard contains six rooms, and is of a superior character. There is a 3-room kitchen and offices at the back, and in front and on one side are flower gardens which add to the annual income by the sale of cut flowers. The dairy is a separate weatherboard building, 15 ft. x 8 ft., and also serves as a store for fruits preserved in syrup and glass, in the preparation of which Mrs. Muscio excels. A separate building is used as an incubator house, as well as a bacon-smoking chamber, when boards and fittings are taken out. The poultry house, 20 ft. x 12 ft., is of a superior character, and kept perfectly clean; the material is weatherboard, with shingle roof, wire front, and an inner nesting room. There are several runs for the poultry, and one that is grassed is kept for special breeds. Leghorns are preferred now for general purposes and to the exclusion of all others, since eggs are largely sold. A wash-house in the new orchard affords a double convenience for household purposes as well as for compounding spray mixtures, &c. The apiary is a neat shingled roof, 20 ft. x 8 ft., with an inner framed stand strong enough to bear a great weight, and with four legs resting in hollowed log water-troughs, so as to baffle the black ants, which kill the bees. Room is provided for fifty hives. The corn barn, 50 ft. x 22 ft., is particularly well built, the roof being of iron, and the stout main posts are sunk 5 feet in the ground as a precaution in time of flood. The hay barn, with a picturesque shingle roof, and upper story for oaten hay, has two divisions on the main floor, in one of which barley in the straw is kept, the grain serving for poultry food. The dimensions are 32 ft. x 22 ft., and a

wing extends on one side forming a five-stall stable, boarded against the south winds, but open to the north. On the other side is the milking-yard, with a length of roof and shelter against the south. Beyond are the piggeries, with similar roof and shelter, providing four single and one double sleeping styes on wood floors raised 12 inches, and opening to slab-paved yards. The troughs are hollowed logs with neat shoots of wood to guide the wash from buckets on the outside. The wharf is within a few yards of the homestead, and has a flight of steps up the bank, and a small pen for shipping swine. When the property was bought, some hundreds of tons of sandstone ballast lay at the old wharf unloaded from sailing vessels calling for maize, and the greater part has been utilised by Mr. Muscio in protecting the bank against the scour of small steamers.

The implements comprise three one-furrow ploughs of local make. The heavy one, drawn by three horses, and to plough hard ground, is by Anderson, of Cundletown, and has attached a 20-inch disc coulter to cut maize stalks. Allen, of the same place, made the plough specially used for covering in weeds, and Manners, of Taree, the little hilling plough. Mr. Muscio has discarded a disc harrow, and finding he cannot control the little Yankee swing plough aspires to possess a genuine English made two-furrow gang plough. The harrows are home-made, and comprise a heavy triangular, which, when weighted and drawn by three horses, alone can be depended on to break down stubborn clods. A long tined harrow is used to root out weeds and nut-grass. The "Planet" horse hoe is deemed too light, jumping right out, and skipping the weeds through the tines not overlapping. Mr. Muscio regards it as time wasted in having to hand-hoe weeds left by an inefficient implement. A spiked roller has been discarded as a clod-crusher. A "Farmer's Friend" corn-planter is used. In the barn there is a "Veteran" sheller, hand-sheller by Manners, wheelbarrow and corn-cracker by Ames Company; there are also a horse-gear, wood roller, dray, slide, buggy, the appliances for a small hand-dairy, and 150 feet of hose for the garden.

The farm is divided as follows :—Under cultivation, 31½ acres; pasture, 13 acres; orchard, 5 acres; homestead, ½ acre; total 50 acres. The cropping this season is maize; 30 acres, with pumpkins interspersed, also 1½ acres additional in pumpkins, put in after oats and barley just harvested. In the 8 acres of new orchard, potatoes, lucerne, and melons are being grown. The cultivation of maize is to thoroughly prepare the ground, open a furrow, and follow with the planter, and weeds are kept down by frequent horse and hand hoeings. The variety sown is "Golden Drop," got two years ago from a neighbour, and has always proved a good corn. It is sown at the end of October, for late maize is generally blighted, yet weevils attack too early corn in the field. The crop throughout was very clean, of a good height, the leaves not over luxuriantly green, and in the forward plots the cobs swelling promised a yield of about 50 bushels to the acre. Very little space was left between the crop and the fences, and corn is sprinkled thickly on the edges when sowing is in progress so as to feed bandicoots and save that drilled. An acre next the homestead has been kept for green barley and imphie, the cut stuff being thrown over the fence at a place where a second low rail prevents trampling.

Two years ago Mr. Muscio grew fourteen varieties of potato, and none succeeded like "Snowflake." The one acre in the new orchard was planted with seed that won a prize at a local show, and the yield promises to be fair and the tubers large and clean skinned, but few seasons have suffered so much from high winds as the present. The Manning soils, without manure, will not allow of double cropping.

Manure receives careful attention on this farm, in that it is kept under cover, and all that can be gathered from stables, milking-yards, and piggeries is there heaped up. Owing, however, to want of trampling and moisture, the heap was somewhat fiery. The shelter forms an excellent feature, but a covered sunk yard should be provided, to which pigs have access, so that their rooting, trampling, and urine would make the manure. The soakage from exposed heaps and yards carries off all the soluble plant nutriment, whilst proper fermentation cannot be secured without attention.

Fodder is provided by the growth of oats for hay and barley, reaped by hand, the grain serving for poultry food. Both were stored in the hay barn. Some grass-land has been laid down, 6 acres being sown two years ago with rye-grass, prairie, and white clover. Since then the grazing has been continuous, and the rye shows a tendency to die out, and, possibly, the land would be better under cultivation.

A portion of the lagoon paddock, about 2 acres, which is wet after floods, but gets dry in summer, was planted a few years ago with osiers, but the variety was said to have been wrong, and they have been taken out. At present rushes have choked all grass, although water couch does well. They will, however, die out in time. Nut-grass, introduced by the last flood, has taken firm hold of many places in the farm, despite continuous attempts to dig it out. A final effort is to be made by letting swine root it. Its nodular roots may be found at a depth of 6 feet, and constant cutting off of the leaves by horse or hand hoe apparently does no good. It is possible that dense couch or prairie or sorghum may stifle it, but in the absence of experiments Mr. Muscio has had to hire labour to dig it out.

The live-stock comprise 4 horses, 12 cattle, 12 swine, and 292 head of poultry. The 3 plough-horses are of a good type, and the light horse is used for saddle or buggy. There are 6 milch cows (one is said to have had a Holstein mother; at all events, both she and her daughter are the two best milkers), 3 heifers, and 3 calves. Last year the stock was reduced to 12, since Mr. Muscio had not time to look after so many. They have a 40-acre paddock in the bush to run on. The swine comprise one Poland-China boar, three months old, that took a local prize when a youngster, and is a characteristic good hog. The sows of the same breed were in a purposely poor condition, so that they may the more readily root out nut-grass. The market for pigs is Sydney. Poultry are well looked after. Dealers call and collect the eggs and table birds in exchange for goods, and as Mr. Muscio's family is a large one the arrangement serves. £10 was invested in a 70-egg incubator, two years ago, with patent brooder, but a sitting hen is preferred to the "Petaluma." Poultry are allowed free access to the orchards. Powdered oyster-shells and crockery are given. Fortunately, disease is rare, and there is a hospital for the immediate isolation of sick fowls. The houses and yards are kept quite clean, lime and whitewash being freely used, and the fowl manure is reserved for the garden. The bees have proved a trouble of late, owing, it is said, to black ants entering the hives and killing them, wherefor the legs of the apiary stand in water-troughs, and boiling water thrown on the nests kills the ants. Owing to the enthusiasm induced by Mr. Gale's lectures, bees are much sought after on the Manning, and swarms are now difficult to buy.

The vegetable garden suffices for home use, and if hawkers call they are supplied; in fact, more might be done in this line. Mr. Muscio is indebted to the *Agricultural Gazette* for the desire to enlarge the orchard, his interest having been attracted by Mr. Benson's admirable papers on Fruit and Orange Culture. At present the orchard is about 5 acres, but the intention

is to plant 12 acres with trees that bear fruit of excellent quality early, so as to be first in the market. With this in view, he has obtained young selected plants to furnish scions for home-grown stocks. These latter are being grown in large numbers on the banks of the creek that divides the farm into two portions. Quince stocks for pears, peach seedlings, bitter orange and lemon seedlings; loquats for apples. Although many of the purchased orange plants have only been transplanted three months, yet some have furnished forty scions. Not only does the soil lend itself to such rapid growth, but these plants were sent from Mr. Pye's, of Parramatta, with balls of earth in boxes, whereas those that came with their roots wrapped in straw have had a struggle to live.

The following selection may guide others interested in orchards:— Oranges: "Washington Navel," "Mediterranean Sweet," "Federation," and "Frontignac." Some are grafted on lemon stocks, others on the bitter orange. The hint given that grafting is easier when the sap is rising led to many losses, through not covering immediately with a shade from the rays of the sun. The stocks were from seed sown September a year ago, and grafting was done last September. A tree costing 2s. 6d. gave forty scions, of which twenty-five grafts lived, and this economy is within reach of all. In order to shelter the orchard from strong winds that do much damage, trees are necessary; and in order to grow profitable trees, external and internal cross-rows of "White Orange" have been planted. It is hoped that the fruit will be ready early in January for the Sydney market. Other varieties of orange are being tried, such as "Holdfast," "Early Acme," and "Late Acme." No lemons will be grown, since they are deemed unprofitable.

The following pears have been selected:—"Early Christmas," with a view to an early crop, and "Beurré Giffard" will be tried; for long keeping, "Beurré de Rance," which is said to keep six months after pulling; and for export to England "Winter Nelis" is deemed indispensable. These trees are to be grafted on home-grown scions.

For apple stocks, loquats have been chosen, since they appear to defy all attacks. The following have been selected:—"Smith's Early Red," "Winter Pearmain," "Jupp's Surprise," "Frampton's Late," "Golden Russet," "Ribstone Pippin," and "Golden Pippin." For apricots, "Neverfail" is preferred, since it is a great bearer, and originated fifteen years ago in the Colony. Peaches grow luxuriantly, and on the banks there are a great number ready for grafting, "Howard's Early" being the favourite for scions. The aphis has been driven away by constant syringing with kerosene emulsion. Black ants frequently kill young trees, but boiling-water on the nests exterminates them. Persimmons take with the public, and 117 trees have been put in, 17 ft. x 17 ft., and occupy nearly an acre.

Book-keeping is merely a record of sales and purchases. The labour is that of Mr. Muscio, with hired help at times.

The subsidiary aids are co-operative family labour, carpentry and building, light repairs, sales of dairy produce, bacon, eggs, table-birds, vegetables and flowers, and making of preserved fruits. The points of interest are drainage, enterprise in building the homestead, and planting a 5-acre orchard, to be extended to 12 acres; the development of the minor industries of the farm, such as poultry, bees, and flowers; the making of manure under cover.

The management, with a view to profit, has been excellent. The planting of a large orchard is being conducted with skill and economy, and the ideal of early or late fruits of the best sorts is worthy of note. The returns for 1892 show that maize realised £203; live-stock, £64; and the smaller industries, £46; in all, £313, from a 50-acre farm worked by one man.

Mixed Farms under 200 acres.

	Points.	Haywood Bros.	Muscio, D.	Dening, E. J.	Johnson, J. W.	M'Lachlan, H.	Gibson, E.	Doust, D.	Green, G. K.	Waters, M.	Swan, W.
System of underground drainage*	50*	45	40	40	45	...	35	50	30	...	35
Conservation of water, and its economical application...	80	60	60	60	60	60	60	60	50	50	60
Character and condition of fences, gates, &c.	40	34	38	31	28	31	28	29	28	25	28
Plan, character, and condition of farm-house, buildings, &c. ...	40	36	36	36	34	34	34	36	31	25	29
Kinds of implements, condition, &c.	60	59	53	53	60	52	47	55	47	45	37
System of cultivation, rotation, &c.	80	77	80	80	79	78	68	75	76	78	58
State of crops as to cleanness and cultivation	100	99	96	99	99	96	96	94	94	97	96
Productiveness of crops	50	50	50	50	50	50	49	50	50	50	49
Conservation of manure made on the farm	50	42	50	45	42	44	32	40	38	31	10
System of manuring*	50*	...	...	...	...	...	...	...	...	...	...
Means used for conserving fodder	60	41	33	33	33	33	36	33	35	38	25
System of laying down grasses	20	20	15	10	5	10	20	5	10	10	20
Class and condition of stock	50	49	48	46	45	45	49	39	44	48	40
Vegetable and fruit garden	25	24	25	25	8	16	14	9	23	15	4
Mode of book-keeping	20	10	7	7	7	7	8	7	7	7	8
Number and condition of subsidiary aids to farm	80	65	55	52	50	48	50	45	53	52	30
Any new point of interest and commercial value, such as new crops, ensilage, &c.	20	14	15	13	10	10	9	12	13	12	7
General management, with a view to profit	125	114	120	119	115	109	115	108	110	105	94
Total points	1,000	839	821	799	770	723	750	747	739	688	630
Highest number of points*	...	950*	950*	950*	950*	900*	950*	950*	950*	900*	950*
Percentage of points...	...	88·31	86·42	84·10	81·05	80·33	78·94	78·63	77·78	76·44	66·31

* Note.—The prizes will be awarded to the entries gaining the highest percentage of excellence—not necessarily the greatest total of points. Thus, in the event of any of the improvements indicated with an asterisk (*) being deemed by the judge unnecessary on any competing farm, the points allotted to that subject will not be included in the *total maximum* of points, and the *percentage of excellence* will be calculated accordingly. Thus, a competitor who gains 700 points on a farm that is judged to need artificial drainage would receive a mark of excellence, 700 out of a possible 1,000—equivalent to 70 per cent.; but a competitor gaining the same number of points on a farm that is judged to need *no* artificial drainage would receive a mark of excellence, 700 out of a possible 950—equivalent to 80 per cent.

MIXED FARMS under 200 acres.

Order of merit.	Competitors.	Drainage.					Water conservation.						Fences, gates, roads.									Homestead.							
		Area.	Drains.	Difficulty.	Special merit.	Total.	Household.	Farmstead.	Paddocks.	Irrigation.	Water-power.	Total.	Style of fence.	Condition of fence.	Condition of gates.	Condition of roads.	Gates or slip-rails.	Hedges, stone walls.	Trees planted.	Special merit.	Total.	Plan, farmhouse.	Character, farmhouse.	Condition, farmhouse.	Plan, farm buildings.	Character, farm buildings.	Condition, farm buildings.	Special merit.	Total.
		15	15	15	5	50	20	20	20	10	10	80	5	5	5	5	5	5	5	5	40	6	6	6	6	6	6	4	40
1	Haywood, Bros.	10	15	15	5	45	20	20	20	...	...	60	5	5	5	5	4	...	5	5	34	6	6	6	5	5	4	4	36
2	Muscio, B.	10	15	15	...	40	20	20	20	...	...	60	5	5	5	5	5	5	5	3	38	6	4	6	6	4	6	4	36
3	Dening, E. J.	10	10	15	5	40	20	20	20	...	...	60	5	5	5	5	4	...	3	4	31	6	4	6	6	4	6	4	36
4	Johnson, J. W.	10	15	15	5	45	20	20	20	...	...	60	5	5	5	5	3	...	...	5	28	6	4	6	4	4	6	4	34
5	McLachlan, H.	...	...	...	...	...	20	20	20	...	...	60	5	5	5	5	3	5	...	3	31	6	6	6	4	4	4	4	34
6	Gibson, E.	15	10	5	5	35	20	20	20	...	...	60	5	5	5	5	3	...	1	4	28	6	6	6	6	4	4	2	34
7	Doust, D.	15	15	15	5	50	20	20	20	...	...	60	5	5	5	5	4	...	...	5	29	6	6	6	6	4	4	4	36
8	Green, G. K.	10	10	10	...	30	20	20	10	...	...	50	5	5	3	2	3	2	5	3	28	6	4	6	4	4	4	3	31
9	Waters, M.	...	...	...	...	...	20	20	10	...	...	50	5	5	5	5	3	...	2	...	25	4	4	4	4	3	4	2	25
10	Swan, W.	10	10	15	...	35	20	20	20	...	...	60	5	5	5	5	3	...	...	5	28	4	4	5	4	4	4	4	29

Mixed Farms under 200 acres.

Name	Implements.						System of cultivation and rotation.									Cleanness and cultivation.								Productiveness.				
	Tillage.	Harvest.	Marketing—Dairy.	Vehicles—Harness.	Special merit	Total.	Cereals.	Hay crops.	Fodder crops.	Potatoes, Pumpkins.	Special -Tobacco, Cane, Melons, &c.	Special merit.	Rotation.	Special merit.	Total.	Cleanness of cultivation.	Few rank weeds.	Clean fences.	Clean headland.	Special merit.	Method of cultivation.	Special merit.	Total.	Cereals.	Fodder—Pumpkins, Grass.	Potatoes, Cane—Special.	Special merit.	Total.
	15	15	15	10	5	60	10	10	10	10	10	10	10	10	80	40	5	5	5	5	30	10	100	15	15	15	5	50
Haywood Bros.	15	15	15	10	4	59	10	10	10	10	8	10	10	9	77	40	5	4	5	5	30	10	99	15	15	15	5	50
Muscio B.	15	10	15	10	3	53	10	10	10	10	10	10	10	10	80	40	3	5	5	3	30	10	96	15	15	15	5	50
Dening, E. J.	15	10	15	10	3	53	10	10	10	10	10	10	10	10	80	40	5	5	5	5	30	9	99	15	15	15	5	50
Johnson, J. W.	15	15	15	10	5	60	10	10	10	10	10	10	10	9	79	40	5	5	5	5	30	9	99	15	15	15	5	50
M'Lachlan, H.	15	12	15	10	...	52	10	10	10	10	10	9	10	9	78	40	5	4	4	4	30	9	96	15	15	15	5	50
Gibson, E.	10	10	15	10	2	47	10	10	10	10	...	10	10	8	68	40	4	5	5	4	30	8	96	14	15	15	5	49
Doust, D.	15	12	15	10	3	55	10	10	10	10	10	7	10	8	75	40	4	4	4	4	30	8	94	15	15	15	5	50
Green, G. K.	15	8	11	10	3	47	10	10	10	10	10	8	10	8	76	40	4	4	4	5	30	7	94	15	15	15	5	50
Waters, M.	15	5	12	10	3	45	10	10	10	10	10	9	10	9	78	40	4	4	5	4	30	10	97	15	15	15	5	50
Swan, W.	9	6	12	10	...	37	10	10	10	...	...	10	10	8	58	40	4	5	4	3	30	10	96	14	15	15	5	49

Mixed Farms under 200 acres.

Names.	Manures.									Conserving fodder.												Grass land.			Live-stock.					
	Farm-yard stables.	Farm-yard cows.	Farm-yard pigs.	Farm-yard fowls.	Field, ploughed in.	Rubbish gathered.	Mud, silt, fertilisers.	Special merit.	Total.	Resting grass paddocks.	Grass hay.	Cereal hay.	Ensilage.	Mowing machines.	Food preparation machines.	Horse power.	Barn.	Hay-shed.	Stacks.	Special merit.	Total.	Condition of pasture.	Special merit.	Total.	Plough-horses.	Light horses.	Cattle.	Swine.	Sheep and special merit.	Total.
	5	5	5	5	5	5	5	15	50	5	5	5	10	5	5	5	5	5	5	5	60	15	5	20	10	10	10	10	10	50
Haywood Bros.	5	5	5	5	5	...	5	12	42	5	4	4	...	4	5	3	5	3	3	5	41	15	5	20	10	10	10	10	*9	49
Muscio B.	5	5	5	5	5	5	5	15	50	...	5	5	...	...	5	3	5	5	...	5	33	10	5	15	10	10	9	9	10	48
Dening E. J.	5	5	5	5	5	5	...	15	45	...	5	5	...	...	5	3	5	5	...	5	33	10	...	10	10	10	10	9	7	46
Johnson J. W.	5	4	5	5	5	5	...	13	42	...	5	5	...	...	5	3	5	5	...	5	33	5	...	5	10	10	9	9	7	45
M'Lachlan H.	5	3	4	5	5	5	5	12	44	...	5	5	...	5	5	3	5	...	...	5	33	5	5	10	10	10	9	8	8	45
Gibson E.	5	5	5	5	5	2	...	5	32	5	5	5	...	5	5	3	5	...	...	3	36	15	5	20	10	10	10	9	*10	49
Doust D.	4	3	4	5	5	...	5	14	40	...	5	5	...	5	...	3	5	5	...	5	33	5	...	5	10	8	8	8	5	39
Green G. K.	5	3	5	5	5	3	3	9	38	3	5	5	...	...	5	3	5	5	...	4	35	10	...	10	10	10	9	8	7	44
Waters M.	5	2	5	4	5	...	...	10	31	1	5	5	...	5	5	3	5	5	...	4	38	10	...	10	10	10	9	10	9	48
Swan W.	...	5	...	...	5	...	...	...	10	5	5	5	...	...	5	...	5	...	...	...	25	15	5	20	10	10	10	...	10	40

MIXED FARMS under 200 acres—*continued.*

Names	Garden & Orchard.				Bookkeeping.					Subsidiary aids.																					
	Kitchen garden.	Orchard.	Special merit.	Total.	Sales and purchases.	Ledger.	Farm data.	Balance-sheet.	Total.	Labour—Family.	Do. building	Do. implement making.	Do. light repairs.	Do. heavy repairs.	Sales of dairy produce.	Do. poultry produce.	Do. honey.	Do. vegetables.	Do. fruits.	Do. cereal seed.	Do. garden seed.	Do. potatoes.	Do. nursery stock, grass, cane, &c.	Do. live stock.	Hire of implements, &c.	Meat and bacon.	Pig-breeding.	Poultry-keeping.	Butter-making.	Power—horse, water, steam.	Total.
	10	10	5	25	5	5	5	5	20	2	2	2	2	2	2	2	2	2	2	2	2	2	4	10	10	5	5	5	5	10	80
Haywood Bros.	10	9	5	24	5	...	5	...	10	2	...	2	2	1	2	2	2	2	2	2	2	2	3	9	5	5	5	5	5	5	65
Muscio B.	10	10	5	25	5	...	2	...	7	2	2	2	2	1	2	2	2	2	2	1	1	2	2	7	...	5	5	5	3	5	55
Dening E. J.	10	10	5	25	5	...	2	...	7	2	2	2	2	...	2	2	...	2	2	2	...	2	4	5	...	5	5	5	3	5	52
Johnson J. W.	4	4	...	8	5	...	2	...	7	2	...	2	2	2	2	2	...	1	1	2	...	2	2	7	...	5	5	5	3	5	50
M'Lachlan H.	8	8	...	16	5	...	2	...	7	2	2	2	2	...	2	2	...	1	1	1	...	1	2	7	...	5	5	5	3	5	48
Gibson E.	8	6	...	14	5	...	3	...	8	2	2	1	2	...	2	2	...	2	1	...	...	...	2	9	...	5	5	5	5	5	50
Doust D.	5	4	...	9	5	...	2	...	7	2	2	2	2	2	2	1	1	1	1	1	...	...	...	5	...	5	5	5	3	5	45
Green G. K.	9	9	5	23	5	...	2	...	7	2	2	1	2	...	2	2	2	2	2	2	1	2	2	6	...	5	5	5	3	5	53
Waters M.	10	5	...	15	5	...	2	...	7	2	2	1	2	...	2	2	...	2	2	2	1	2	...	9	1	4	5	5	3	5	52
Swan W....	2	2	...	4	5	...	2	...	7	2	2	...	2	...	2	2	...	1	...	1	...	...	2	6	...	5	...	5	...	...	30

MIXED FARMS under 200 acres—*continued.*

Names	Experimental culture.	Nursery culture.	Fruit-culture.	Vegetable-culture.	Any new crop.	Power, steam, or water.	Superior implements of tillage.	Superior implements of harvesting.	Tool-shop.	Superior dairy.	Ensilage.	Green crops.	Superior pasture.	Laying down pasture.	Superior hay-barns.	Special merit.	Total.	Tillage.	Cropping.	Live stock.	Marketing of farm produce.	Marketing of dairy produce.	Marketing of orchard produce.	Co-operative labour.	Home repairs, &c.	Class of machinery.	Special merit.	Total.
	Points of interest.																	Management with a view to profit.										
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	5	20	10	10	10	10	10	10	10	10	10	35	125
Haywood Brothers	...	...	1	1	...	...	1	...	1	1	...	1	1	1	1	5	14	10	10	10	10	10	5	10	5	9	35	114
Muscio B.	1	1	1	1	...	...	1	...	1	1	...	1	...	1	1	5	15	10	10	10	10	10	10	10	8	9	33	120
Dening E. J.	1	1	1	1	1	...	...	...	1	...	...	1	...	...	1	5	13	10	10	10	10	10	8	10	8	8	35	119
Johnson J. W.	1	...	...	1	...	...	1	...	1	...	...	1	...	...	...	5	10	10	10	10	10	10	...	10	10	10	35	115
M'Lachlan H....	1	...	...	1	...	...	1	...	1	...	...	1	...	...	...	5	10	10	10	10	10	10	...	10	5	9	35	109
Gibson E.	...	...	...	...	...	...	...	...	...	1	...	1	1	1	...	5	9	10	10	10	10	10	5	10	5	10	35	115
Doust D.	1	...	...	1	1	...	...	...	1	1	...	1	...	...	1	5	12	10	10	10	10	10	...	10	10	8	30	108
Green G. K.	1	...	1	1	...	...	...	1	1	...	...	1	1	1	...	5	13	10	10	7	9	9	9	10	3	9	34	110
Waters M.	1	...	...	1	...	...	...	1	...	...	...	1	1	1	1	5	12	10	10	10	10	5	5	10	5	8	32	105
Swan W.	...	...	...	...	...	...	...	...	...	...	1	...	1	1	...	5	8	10	10	10	10	10	...	9	...	...	35	94

Practical Vegetable Growing.

Directions for the Month of April.

In many portions of New South Wales the weather becomes very cool during April, and not infrequently rain prevents much work being done in the garden. Advantage of fine weather should be taken to dig up new ground and make it ready for planting and sowing. Not a weed should be allowed to grow, and all old and useless vegetables and remains of vegetables should be gathered together and either burnt or allowed to rot and make good compost for the garden. If burnt, the ashes should be carefully preserved, spread over the ground and dug in.

In some of the warmest of the coast districts many vegetables may be grown, which it would be quite impossible to raise in the cool climates. This is the case with French beans, which the writer has seen growing well and producing freely in the middle of June in the Tweed and Richmond Rivers districts. Such productions should be of considerable value if it were possible to send them to the metropolitan markets. Tomatoes also grow wild in some favoured localities, and bear fruit throughout the year. This may seem surprising to those who live in districts subject to severe frosts, snows, and ice. For its small area this Colony is a truly wonderful country, having almost every climate under the sun, from the extreme Alpine cold of Kosciusko to the almost tropical heat of the Tweed.

Vegetables such as cabbages, cauliflowers, &c., should be kept quite free from weeds, and the ground between the rows should be chipped up with a hoe as often as can be done conveniently, but not whilst the ground is very wet, for this would make it into a sort of paste. If the vegetables are not growing as well as should be expected, it is recommended that some liquid manure should be given them. This can be made from the droppings of cow, horse, sheep, or fowls. The sheep manure is very strong, and it dissolves better than any other of the above-mentioned manures. It very often contains a vast quantity of seeds of weeds, and for this reason it is as well perhaps to use it in a liquid state, for after mixing and stirring it up well in the water it can be strained without difficulty, and the seeds will either be removed or else settle at the bottom of the vessel containing the liquid. Fowl manure, used fresh, makes an excellent liquid manure. A little experience will soon show what strength may be used with impunity. Do not pour liquid manure over the leaves of vegetables, for it will quite injure some kinds. It may be as well to mention that in digging or hoeing between vegetables the soil should not be allowed to fall or be sprinkled over the leaves, more particularly if they are wet with rain or dew.

There should be no need for the use of artificial manures for the farm vegetable garden, as enough animal droppings are almost sure to be available. But if it becomes necessary to use the former, great caution should be exercised so as not to make liquid manure with them too

strong, or apply them in a dry state too thickly. An ounce, or even half an ounce, to a gallon of water will be found quite strong enough for any vegetable. A great aid to the growing of good vegetables is the mulch. This can be made of horse or cow droppings, half rotten straw, leaves, or grass, either alone or mixed up together. The use of a mulch, particularly in dry weather, makes a wonderful difference. If it be possible to save the urine from the cows and horses, it would be most desirable to do so as this forms the best of liquid manure mixed with water. If it be used quite fresh, it may be applied much stronger than if it be kept in a vessel and allowed to ferment.

Asparagus.—Some ground should be made ready for planting this excellent vegetable. It need not be planted until towards the spring, but if the ground is dug up roughly and manured some time ahead, it will become more fit for the plants than if prepared immediately before planting. As the asparagus is a permanent crop, and will last for many years, it would be advisable to take some trouble in digging and manuring the ground; and although its thick fleshy roots are to a great extent surface feeders, and do not descend very deep in search of food, the ground had better be dug 2 feet or at least 18 inches deep, and if the soil is poor, manure may be mixed in at the same time. Coarse bone meal or broken up bones would be useful in addition to farm-yard manure. There is no necessity to put on a heavy dressing of manure, and if the soil is in "good heart" it may not require any. To provide sufficient asparagus for a fair sized family, very little space would be required, say about 15 feet long by 6 feet in width, or even less, but this must be left to individual judgment and convenience for even a dozen well cared, for plants will yield a considerable return. A few plants may perhaps be tried at first, and if the vegetable is appreciated and succeeds satisfactorily more can be planted afterwards.

Beans, Broad.—This vegetable may be sown largely from time to time during the month. It will attain the greatest perfection on rather stiff soil, but a fair crop can be obtained from almost any soil if it be well manured. Sulphate of ammonia is not a desirable manure to apply. Sow the seed in rows about 3 to 4 feet apart, the seed about 4 inches apart in the rows, and about an inch and a half deep. Johnson's wonderful and broad Windsor are both excellent varieties. The dwarf fan bean is a good variety very suitable for small gardens. The rows of this should be about 1 foot apart.

Beans, French or Kidney.—Will only succeed in the warmest parts of the Colony where frosts cannot attack them.

Beet, Red and Silver.—Thin out well the plants which are coming up, and keep the rows free from weeds. It is not advisable to sow any more seed at present.

Borecole or Kale.—A very small quantity of seed may be sown. This is a vegetable hardly worth the growing, for good cabbages are infinitely superior.

Brussels Sprouts.—Which is a sort of cabbage, is one of the best if not the best of that class. It will succeed well in cool climates, and may be treated in every respect as the ordinary cabbage. A little seed may be sown, and if any young plants are obtainable they should be planted out about 2 feet apart each way.

Cabbage.—Sow seed as largely as may be thought necessary, plant out also any young cabbages that may be available. They should not be pulled out

of the seed bed, but taken up carefully without breaking more roots than can be avoided. The early Jersey Wakefield and early dwarf York are both good small varieties. The sugar-loaf is also a good kind. Every garden should have a few plants of the red cabbage, which comes in very useful for pickling. If not required for that purpose, it may be eaten in the ordinary way. It should be noted that cabbages are greedy feeders, and need rich soil and abundance of manure.

Cauliflower.—Sow a little seed, and plant out from the seed bed any strong plants that are large enough to handle. This vegetable should be grown largely, for it is well liked by almost everyone. The ground needs to be well manured like cabbage.

Carrot.—Seed may be sown largely. Make the rows about 1 foot apart, and take care not to bury the seed more than half an inch deep. Be careful to weed frequently, for the seed takes a considerable time to come up, and when it does, the plants are very fine and tender and easily destroyed by weeds. Manure had better not be applied, unless it is old and very rotten, as it induces the carrots to become forked and quite spoiled in appearance. Early Shorthorn and Improved Intermediate are good varieties to sow at the present time.

Celery.—Plant out a few seedlings into very well manured ground, if any are available.

Endive.—If plants are available they may be planted out largely. It is a most useful substitute for lettuce when that cannot be grown. A little seed may be sown.

Leek.—Seed may be sown largely, and any plants from previous sowings that are large enough, say about 6 inches in height, may be planted out. The soil should be heavily manured.

Lettuce.—Sow seed largely, and plant out any young lettuces that are suitable and of sufficient size to handle. The roots should not be broken, if possible, when raising the plants from the seed-bed.

Onion.—This is an important and useful vegetable, and opportunity should be taken now to sow a good quantity of seed. Sandy loam is the most suitable soil for the plant. Well rotted manure should be applied in quantity, the land well drained, and the surface kept somewhat raised and made clean and fine for the seed. The beds should be narrow, so that they can be easily weeded. It should be kept in mind that weeds have a most damaging effect on young onion plants, and must never be allowed to grow and attain any size. The seed should be sown in drills, which should be about 1 foot apart. Care should be taken not to bury the seed deep—indeed it should be little more than pressed into the soil. Sow thin, unless small onions are required.

Parsely.—Sow a small quantity of seed in order to keep up a supply of plants.

Parsnip.—This is a good wholesome vegetable, although not always liked. Sow a few short rows. The ground should be dug deep, as the roots will extend to a great depth, if the soil is free and open.

Peas.—Take the opportunity to sow largely of this general favourite in rows about 3 feet apart. Cover the seed with soil to a not greater depth than 3 inches. The peas should be sown in the drills about 3 inches apart. For manure use well rotted droppings from farm animals. Lime, especially sulphate of lime or gypsum, will be found useful. Potash and superphosphate of lime are good manures to use.

Radish.—Keep on sowing a very little seed from time to time, and root out all old tough plants. Use plenty of well rotted manure.

Spinach.—A little seed may be sown occasionally during the month. Sow in rows about 18 inches apart, and thin out the young plants well when they come up. Use well rotted manure freely.

Shallots.—Plant out a few bulbs, but do not set them deep in the ground. They should stand about a foot or so apart each way. Whatever distance you may think best keep to it, or else everything will have a most unsatisfactory appearance, and be awkward to work. A line should be used on every occasion.

Herbs.—Sow a little seed of any kind it may be wished to grow.

Orchard Notes for April.

The month of April is more or less a slack time for fruit-growers in the coastal districts, as the bulk of the summer or deciduous fruits have been disposed of, and the citrus fruits are not yet ready. There will, however, still be a certain amount of fruit to dispose of, such as late apples and pears, passion fruit, and persimmons, with a few off-crop oranges, lemons, and thorny mandarins. Though there is not much fruit to send to the market during the month, that is no reason why it should not be carefully and attractively packed, so as to show to the best advantage, as it should always be borne in mind that the better the fruit opens up when exposed for sale the more readily it will sell, and the better price it will bring.

During the month the cultivation of the orchard should be attended to, and the ground kept in good tilth and free from weeds. If, during the month there is any spare time, it can be well utilised by doing a little necessary draining, and there is nothing that will pay the orchardist better, especially in the Cumberland district. Drain tiles are always preferable to use, as they are cheaper to lay, last longer, and do more good if properly laid than any other kind of drain. There is no occasion to lay the drains too deep, as a rule drains 30 inches deep and 20 feet apart are the best. On heavy soils liming should supplement draining. All surface drains should be attended to, and where there are underground drains the outlets should be examined so as to see that there is a good get away for the water. In the latter districts all late apples and pears should be gathered and stored for winter use, taking care to handle the fruit as carefully as possible, and to store nothing but perfectly sound fruit. All bruised, blemished, or wormy fruit must be rigidly excluded, as if mixed with the sound fruit, it will not only rot itself, but in rotting will probably cause several adjacent fruit otherwise perfectly sound to rot also. The fruit containing codlin moth should be carefully excluded from the sound fruit and destroyed, and the building used to store the fruit should be so arranged as to offer as little shelter as possible to the larvæ of the moth. If there is time, all fruit cases should be carefully disinfected, as this will destroy many forms of disease, both insect and fungus, and if done well before they are required for citrus fruit, they are not likely to be overlooked, which will very probably be the case if left till spring. The best way to disinfect the cases is to immerse them in boiling water for not less than five minutes, which will effectually destroy all fungus germs or insects. A shorter immersion would not be sufficient, especially in the case of the codlin moth, as the larvæ is so well protected by its covering that it is difficult to reach. If fungus diseases of any kind or pear mite have been prevalent in the orchard during the season, vast numbers of the spores (seeds) of the fungi and large numbers of the pear mite may be easily and readily destroyed by gathering up and burning the fallen leaves of the diseased trees, so that when this can be done it should always be attended to. No diseased

or rotting fruit should be allowed to lie under the trees, as it is simply breeding disease. This is especially so in the case of the bitter rot of the apple, where it is the chief means of spreading the disease, so that all rotting and diseased fruits should be gathered up and destroyed by burning.

All dead, diseased, or undesirable trees that are to be removed from the orchard can be dug up during the month, and the hole from which they have been dug can be left open, and the adjacent ground left in a rough state, in order to expose as great a surface as possible, so that the ground may be thoroughly sweetened before planting a young tree in the place of the one removed. The work in the orchard nursery will consist mainly in keeping the land in good order and free from weeds, as the young trees are not likely to make much more growth, but have only to mature their wood.

General Notes.

Cool Buildings.

It is often remarked by new-comers to the Northern Australian colonies that very little attention is given to the construction of buildings with a view to coolness during the almost tropical heat of our summers.

In older settled countries, having a similar range of temperature to ours, the buildings are of a much more solid construction, massive walls and substantial roofings are relied upon to moderate the temperature, while the buildings themselves are so arranged in clusters or groups as to ensure currents of air circulating amongst them.

In Canada and the North-west States of America houses and barns, stables and stores, are built of logs squared on two faces with the adze, and where timber is not sufficiently plentiful to permit of this, "dug outs" are made on hill sides, the solid earth forming the walls on three sides, and the roofs are covered with grass sods, forming a sure protection against the summer heats as well as the winter cold.

In Central America as well as in Egypt and many other hot climates, walls of dwellings are constructed of considerable thickness, built of adobé or unburnt bricks. Some of these are reported by recent travellers to be of very great age and still perfect, and it is said that the interiors of these adobé buildings are of marvellous coolness.

One of the great difficulties which dairying in this Colony, and especially in the northern part of it, has to contend with is the heat and the great variation in the temperature from day to day and at various times of the same day.

A great point of excellence in both butter and cheese is uniformity of quality and flavour, and it is extremely difficult to secure uniformity in a dairy where the temperature is constantly subject to great variations. Some of the dairy companies have gone to great expense in order to avoid these changes of temperature by double walls, deep verandahs, &c.

Want of capital is usually pleaded as the reason why farmers and selectors do not erect more substantial buildings; but it is quite possible that if it was more generally known that solid structures, cool in summer and warm in winter, can be built at the same, or even at less, cost than those now generally put up, many of our farmers would build them in preference.

A representative of this Department calling at the farm of Mr. Thos. Rixon, East View, Rocky River, on business on a very hot day, was much struck with the coolness of the room in which he was received, and, remarking upon it, was told by Mr. Rixon that it was built of mud, and was always cool, that he had built several such, and was about to build a similar one as a dairy for E. C. Bloomfield, Esq., of Salisbury Court.

Mr. Rixon very readily entered into particulars, which we publish in the hope that they will prove useful to our readers; and we shall be glad if any who have had experience of such buildings will supply us with further information on the subject.

Mr. Rixon said it did not require any extraordinary skill to build them; any man of average ability could do it. "It is quite simple. We take fine ironstone gravel, mixed with some earth, or just as it would come from the pit, top and all. We mix it like mortar, and we mostly put in some short rotten straw or chaff to make it hang together, and use a potato fork to put it up with. You want a stone foundation and some galvanised iron to cover it up with, and that is about all there is in it."

It is in fact concrete building made without cement, the ironstone gravel forming the concrete. All who have had much to do in breaking up new land have found patches of ground which, when worked at all wet, will cake as hard as cement in the next dry spell. That is the sort of soil to use. It is pretty plentiful in patches in most parts of the Colony. Some volcanic sands found in Italy have the same property, and are used in making cements which have a good reputation.

The method of building is shortly this: the foundation is dug out to a sufficient depth, according to the nature of the subsoil; in some it is needful to lay a course of rough stones (rubble). The tempered mud and gravel is then laid about a foot in depth and not less than 15 inches in width, boards or slabs being used to keep the sides even. This is completed round the walls; door-sills, and frames being put in their proper positions. In wet weather it is necessary to protect the concrete from rain, and in very hot weather it should be shaded from the sun to prevent too rapid drying. Where ventilation is desired it is well to make a wooden frame of the size desired, and bed it in about a foot from the outside ground-level. The opening thus left may be protected with wire-gauze or perforated zinc or tin, to prevent the entrance of insects and reptiles (snakes, frogs, lizards, &c.)

The first course having been laid, and having become sufficiently firm to carry the next, the process is repeated, window sills and frames being built in where required. When the walls have been completed to the desired height, the wall-plates are put in position and the roof put on in the usual way. Mr. Rixon has roofed his own place with straw-thatching, which in some circumstances is the best possible roofing, being impervious to heat, perfectly water-tight, and very durable; but it has some disadvantages. In some places, it affords harbour for vermin and sparrows, and where grass, cane-trash corn-stalk, or scrub are being burned off, or bush-fires are raging it is rather risky. Where there is a liability to these risks a galvanized-iron roof is much safer, and not much more costly.

The great objection to iron-roofing is that the heat from it strikes downwards during the day, and condensed moisture drips from it at night; but both these faults can be obviated at a slight expense by a lining of glazed calico or hessian, or stiff paper nailed to the under side of the rafters leaving a clear space of some 4 inches or more between it and the iron.

This space is of course an air-space, and the air in it will be kept in motion by the heat of the iron heating the air, which will, being lighter, find its way up to and out at the ridge capping, and its place will be taken by cooler air entering at the eaves, and so a constant current will be kept up. The air in the building will be always cool, and there will be no condensation of moisture to cause a drip at night.

The Willesden Paper-mills, near London, made several kinds of paper suitable for this purpose, and the Australian Asbestos Company of Melbourne make several fabrics well adapted for it, and also for roofing purposes. Almost any storekeeper can supply, or procure, a packing-paper glazed with black varnish on one side, such as is used in packing goods for shipment;

but any moderately tough paper will answer the purpose, which is simply to maintain a moving body of air between the iron and itself. There is no strain on it.

The importance of cool places on a homestead can scarcely be over-estimated. A cool dairy is essential to the making of good butter and cheese; a cool place is wanted for storing fruit, for curing bacon, and for keeping provisions, and for sorting, bulking, and curing tobacco-leaf. A cool dry place for the latter purpose will make a penny per pound difference in the value of the crop.

Mr. Bloomfield was good enough to answer our inquiry as to how the dairy answered its purpose, and said: "The dairy built of mud for me by Mr. Thomas Rixon is proving very satisfactory; the temperature is even, and the dairy is 10 degrees cooler than any other building on the place. The cost is much less than I could have got it built for of any other material."

Insects for Identification.

Attention is again drawn to the collection of insects, friends and foes, being formed by this Department, and for this purpose the Entomologist invites communication upon insects of economic interest whose attacks affect the well-being of plants and fruits; in return, early advice as to remedies and preventives will be forwarded.

All correspondence should be accompanied by specimens of the pests to which reference is made, and also, if possible, by material—whether fruit, foliage, grain, or timber—illustrating the manner in which the harm is done. Whenever possible the insects should be sent alive, securely packed in tin or wooden boxes, in which they may be sent through the post with safety. On no account should cardboard boxes be used for posting specimens, as in almost every case they arrive broken and the insects destroyed by the rough handling of the post. The early stages of many insects cannot be determined definitely unless accompanied by the mature or perfect insects, and this is an additional reason for sending caterpillars, grubs, &c., alive, and also accompanied by food, as in many cases they can be kept until they undergo their transformations and arrive at maturity.

The Moreton Bay Fig as a Fodder Plant.

(See August Gazette, 1893, page 609.)

Mr. W. Rae, of Sydney, writes:—

Re Mr. Maiden's account of the Moreton Bay fig as a fodder plant for cattle, I beg to offer a few remarks thereon. Though, perhaps, somewhat limited, it is none the less thorough. I may say I first came to the conclusion like Mr. Maiden, from seeing them eat them when thrown in their way, and I thought to myself, "Well, when they are so fond of them they must be good, although a bit gummy." The result of my observations was, I would give them a trial, although warned repeatedly not to do so, as it would give the milk a disagreeable taste, and lead to constipation in the cows. However, I thought differently, and carried on in secret for some time—about six weeks—during which time they received them almost every day. I then said I would give them a trial, although told the same old story of tainted milk and injured cow. You can judge of their surprise, then, when I told them I had been using the leaves for some time, and the milk had no ill effects or taste perceptible.

I have been feeding all the winter regularly, with the addition only of a little lucerne, and what grass they pick up; but, as Mr. Maiden says, it is not much if there are any leaves about, although I shut them out from the leaves sometimes a few hours daily, as I thought it might act as a sort of corrective against the eating of the leaves. However, I have no cause to regret giving them, as the increased supply of milk amply testifies to their merits as a milk-producing fodder plant or tree.

I may say it is very direct in action—so much, that it will double the supply in twenty-four hours, and also keep up the condition as well. As for the milk, I confess it is tainted, but not perceptibly unless attention is drawn to it. It seems a bit glossy to the palate, and leaves a somewhat dry feeling in the mouth after. I may say I have tasted the pure milk from the tree, and was much surprised to find that it was not in the least like the gummy, sticky substance I had met with on hands and clothing. When taken internally it seems to lose all those properties it has when exposed to the air. It was not in the least disagreeable, although somewhat dry to the palate. I am inclined to think myself it is somewhat of a laxative nature.

I may also say the cows drank a great deal more water when eating the leaves—so appreciable, that it might cause different results if denied them. This only applies to the large-leaved, although they take the small as well, but not with the same relish, as they are not of such a succulent nature. I think they ought to be more liberally distributed over pastures and reserves where cattle have access. There will then be no cause to complain of the immense number of leaves which large trees shed.

AGRICULTURAL SOCIETIES SHOWS, 1894.

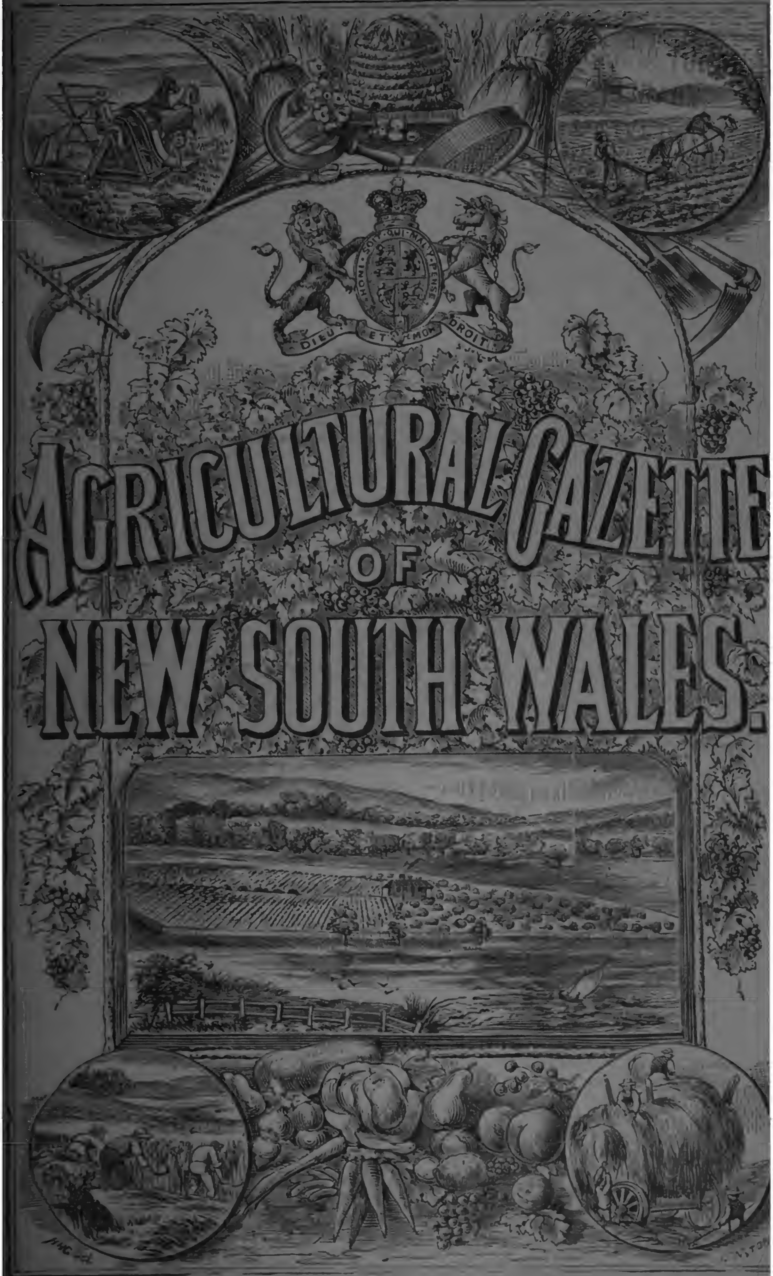
Society.	Secretary.	Date.
Tenterfield P., A., M., and H. Society	J. Hawken ...	Feb. 27, 28, and Mar. 1.
Port Macquarie A. and H. Society	A. E. Poutney ...	Feb. 28 and Mar. 1.
Lismore A. and H. Society...	C. S. Connor ...	,, 28 and Mar 1, 2.
Berrima District (Moss Vale) A., H., and I. Society	J. Yeo	Mar. 1, 2, 3.
Nepean District (Penrith) A., H., and I. Society	R. Benaud ...	,, 1, 2, 3.
Robertson Agricultural Society	R. J. Ferguson ...	,, 6, 7.
Uralla P. and A. Association	J. D. Leece ...	,, 6, 7.
Bega A., P., and H. Society	A. P. Wilson ...	,, 7, 8.
Inverell P. and A. Association	J. M'Ilveen ...	,, 8, 9.
Picton Agricultural Society	G. Bradbury ...	,, 8, 9.
Cobargo A. and P. Society...	J. Graham ...	,, 13, 14.
Tumberumba P. and A. Society	W. Willans ...	,, 13, 14.
Glen Innes P., A., and M. Association	J. Denshire ...	,, 14, 15.
Camden A., H., and I. Society	W. R. Cowper ...	,, 14, 15.
Goulburn Agricultural Society	J. J. Roberts ...	,, 15, 16.
Gulgong Agricultural Association...	T. Turner... ...	,, 16, 17.
Armidale (Combined Show), New England, A. and P. Association	W. H. Allingham	,, 20, 21, 22.
The Royal Agricultural Society (Sydney), N.S.W.	F. Webster ...	,, 21 to 27.
Braidwood P. and A. Association...	G. F. Taylor ...	,, 22, 23.
Castle Hill A. and H. Association...	F. H. G. Rogers...	,, 26, 27.
Orange A. and P. Association	J. S. Thomas ...	,, 28, 29.
Walcha P. and A. Association	H. Chapman ...	April 4, 5.
Lower Clarence (Maclean) Agricultural Society...	J. S. Dunnet ...	,, 4, 5.
Gundagai P. and A. Society	W. E. Kyle ...	,, 5, 6.
Blayney P. and A. Society...	G. H. Woolley ...	,, 5, 6.
Gundaroo P., A., and H. Association	J. Affleck... ...	,, 6.
Namoi (Narrabri) P., A., and H. Association ...	J. Riddle... ...	,, 11, 12.
Bathurst A., H., and P. Association	W. G. Thompson..	,, 11, 12, 13.
Clarence (Grafton) P. and A. Society	T. Page	,, 18, 19.
Wellington P. and A. Association	R. Porter	,, 18, 19.
Hunter River (West Maitland) A. and H. Association	W. C. Quinton ...	,, 18, 19, 20.
Dubbo P., A., and H. Association...	G. H. Taylor ...	,, 24, 25, 26.
Warialda P. and A. Association	W. B. Giddes ...	,, 26, 27.
Mudgee Agricultural Society	J. M. Cox ...	,, 26, 27.
Macleay (Kempsey) A. and H. Association ...	H. R Gray ...	May 9, 10, 11.
Upper Hunter (Muswellbrook) A. and H. Association	Pierce Healey ...	,, 16, 17.
Upper Manning (Wingham) A. and H. Society...	J. J. Herkes ...	,, 16, 17, 18.
Cobar P. and A. Association	A. Roxburgh ...	June 13, 14.
Forbes P., A., and H. Association...	W. G. Domling ...	Aug. 9, 10.
Northern (Singleton) Agricultural Association ...	C. Poppenhagen ...	,, 15, 16.
Cowra P., A., and H. Association...	S. Wright... ...	Sept. 5, 6.

N.B.—Secretaries of Societies are here asked to forward dates of forthcoming Shows as soon as decided upon to enable an early insertion by the Department in the *Agricultural Gazette.*

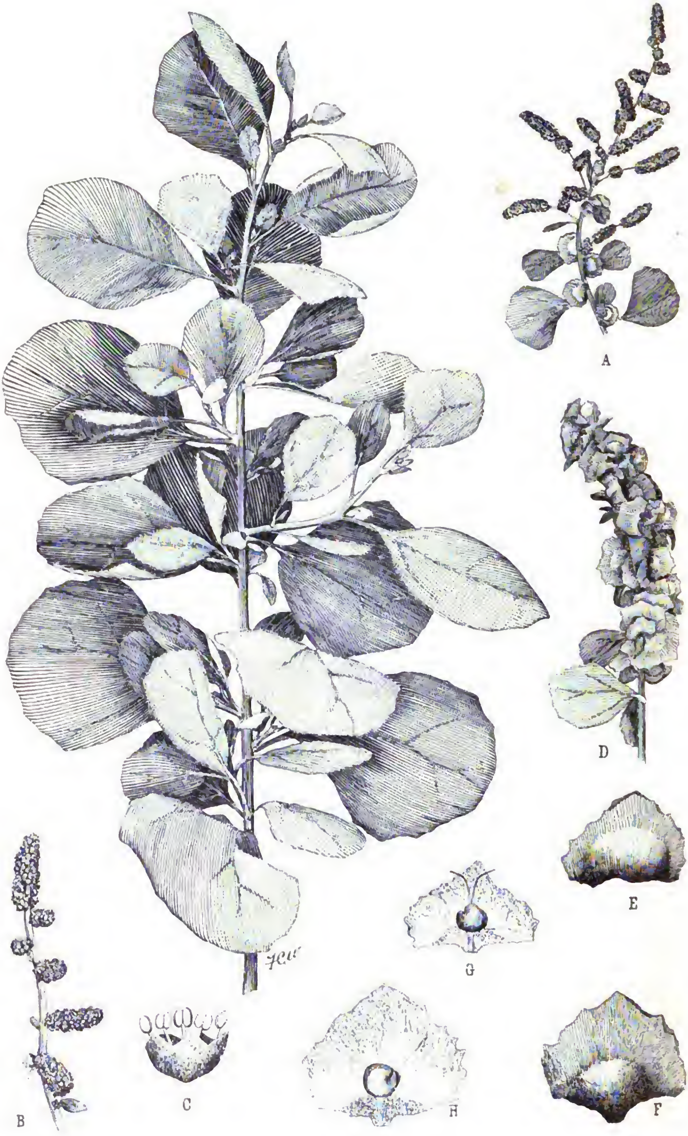
[2 plates.]

Sydney: Charles Potter, Government Printer.—1894.

VOL. V. APRIL, 1894. PART 4.



SYDNEY: CHARLES POTTER, GOVERNMENT PRINTER



(11646-94)

Atriplex nummularia, Lindl.

"An Old Man Salt-bush."

Useful Australian Plants.

BY J. H. MAIDEN,
Consulting Botanist.

No. 9. An Old Man Salt-bush.

(*Atriplex nummularia*, Lindl.)

Preliminary Note.—Salt-bushes belong to the natural order Chenopodiaceæ or Salsolaceæ, which are synonymous terms employed by different authors. The first term is in allusion to *Chenopodium*, one of the genera comprised in it, and the other is called after another genus, *Salsola.* The salt-bush family includes a number of plants which appear to most people very dissimilar. The salt-bushes, of course, include many plants varied in appearance and size. Allied to these are the cotton-bush, and some rather fibrous plants which are apt to give sheep indigestion, while a third group consists of succulent plants, which grow on salt or brackish marsh land. Instances of these are *Salsola* and *Suaeda*, kinds of samphire, which are occasionally used for pickling. Allied to these are some utterly worthless weeds, some native, some introduced, some ill-smelling, and some yielding abundance of seed, and hence hard to eradicate. As it is contemplated to figure and describe other salt-bushes and their allies, readers of the *Gazette* are invited to send fresh flowering or fruiting twigs of any of them to the Department. They will carry in a cigar-box, a tin canister, or even rolled up in a sheet of newspaper, and will go through the post for a trifle. Any notes in regard to their occurrence in a particular locality, or any other points deemed of interest, will be appreciated and acknowledged.

Vernacular Names.—I use the term "*An* Old Man Salt-bush," because there is another "Old Man Salt-bush" (usually cut down to "Old Man," as busy Australians are not inclined to employ four words where two will suffice), whose botanical name is *Rhagodia parabolica.* Our plant is also known as "Cabbage Salt-bush," as it is often employed as a substitute for that useful vegetable.

Botanical Name.—Atriplex is the Latin name for a herb known as Orache, a plant which, like our salt-bush, is now included by botanists under the genus *Atriplex. Nummularia* is also a Latin word, and signifies "coin-like," in allusion to the shape of the leaves.

Value as a fodder-plant.—This is one of the plants whose value as a fodder-plant it would not be easy to exaggerate. Its advantages are that it is nutritious, it yields an enormous quantity of feed in a short time, it seeds enormously, and it may readily be propagated by cuttings. It has been so much appreciated that it is getting scarce. No one in Australia disputes its value, but it is desirable occasionally to remind our people of the worth of our native vegetation. If we are not careful, there are some native plants (of which this may be one), that we shall have to import from other countries.

To avoid useless repetition, I simply refer the reader to Mr. Alston's notes below on the propagation of this plant by seed and other cognate matters.

The leaves make an excellent substitute for spinach or cabbage. This fact should be more widely known.

The chief value of this salt-bush will, of course, be to the pastoralist, who would like to have it on a large scale, but there are many people who may like to try it on a small scale. For instance, where sufficient cannot be grown to form a large proportion of the diet of an animal (as, for instance, in the case of those dwellers in towns or suburbs who keep a cow or a horse), a few bushes about the place will be found most appetising fodder, and to form a convenient medium for administering part of the salt necessary for healthy existence, but care must be taken to keep the salt-bushes where herbivorous animals cannot break them down and devour them. If a moderate amount of care be exercised in cutting down or breaking off the branches, the salt-bush, whose foliage is of a mealy whiteness which is ornamental, will preserve its shapely appearance for a considerable time.

The following analysis of a sample of this salt-bush from the Narrandera district is by Mr. W. A. Dixon (Proc. Royal Society, N.S.W., 1880, p. 138):—

Oil	2·18
Carbo-hydrates	42·85
Albuminoids	16·45
Woody fibre	7·24
Ash (reckoned as carbonates)	31·28
	100·00
Nitrogen	2·63
Woody parts of plant	10 per cent.
Edible	90 ,,

An analysis of the ash is also given.

Following is an analysis of the Cape Salt-bush (*A. halimus*), by Mr. Charles F. Juritz, M.A., Analyst to the Department of Agriculture of Cape Colony:—

Carbo-hydrates	63·37
Albuminoids	4·78
Woody fibre	7·98
Ash	23·87
	100·00

Comparing these results with those obtained by Mr. Dixon for *A. nummularia*, Mr. Juritz remarks:—"It will be observed that, according to the above results, the carbo-hydrates, which constitute the fat-forming material *par excellence* in plants, are more abundant in the Cape plant. The Australian salt-bush, on the other hand, contains a good deal more albuminoid, *i.e.*, nitrogenous or strength-giving constituents." (*Agric. Journ.*, Cape, 15th June, 1893, p. 223).

But I would warn pastoralists against comparing the two analyses too closely. They have been made by two different chemists, who may have operated upon plants in different stages of development, and the raw material may have differed in various ways.

The Old-Man Salt-bush at the Cape.—On the principle, I suppose, that "a prophet is not without honour, save in his own country," our good friends at the Cape are paying more attention to, and seem altogether more appreciative of this valuable plant than we are. The following notes are taken

from the *Agricultural Journal*, 18th May, 1893, p. 178 (the official organ of the Department of Agriculture of the Cape of Good Hope). The report is by Mr. E. Garwood Alston, of Van Wyk's Vlei Estate:—

"In April, 1886, we received six seeds of *Atriplex halimoides*, one of the Australian salt-bushes, for trial here. Only two came up; one died before reaching maturity, and the other represents the mother plant of all the *A. halimoides* found in this country.

"Later on we received from Professor MacOwan, a second packet of *A. halimoides* and also *A. nummularia*, but as we had established the first named, only *A. nummularia* was sown, with the result that in a year's time we were in possession of a patch large enough to supply seeds in fair quantities to farmers and others. (The original seeds were sent by Baron von Mueller.) All the seeds were sown from half an inch to one inch deep in brackish clay soil, and after the plant once commenced to mature its seed, it propagated itself rapidly enough to enable us to keep up the supply in spite of heavy demands every year.

"I should not like to say that, as a fodder plant, the Australian species is better than our own *A. halimus*, but the popular idea locally is that the Australian species is less salt, and consequently more can be eaten by cattle and sheep.

"Our own preference for the stranger is caused by the larger quantity of food produced in a given time, its capability for seeding profusely for nine months out of the twelve, and the ease with which it can be raised. At Van Wyk's Vlei the following animals feed on it in preference to our native *Atriplex*:—Cattle, horses, donkeys, sheep, goats, pigs, fowls, and even ants! It is just possible that the reason may lie in the ability of *A. halimus* to absorb more saline matter from the soil than its cousins; and, if so, it is *primâ facie* an argument in favour of the Cape plant being sown in preference to the Australian where there is but little salt in the soil.

"The drawback to the Cape species is the small number of fertile seeds it yields yearly, and its failure to find out the defensive habit its cousins have acquired to keep the soil cool and moist for the seedlings, by dropping over them a heavy mulching of withered leaves and seed. Apparently *A. halimus* is more particular in the choice of soil than those now acclimatised, but on this point I should like more information.

"During drought I have known cattle, horses, and sheep to browse and thrive upon these Australian fodder plants, a most decided preference being given to them, although the surrounding ground was covered with other species of salt-bushes."

Mr. Alston then gives an account of the extensive introduction of this species into the Orange Free State and the Transvaal, to say nothing of its distribution over Cape Colony. Between January, 1892, and January, 1893, Mr. Alston supplied the Government of the Orange Free State with four woolpacks of the seed.

"Up to this time we had been supplying seeds by post 1s. per lb., which included cost of collection, bag, and postage; at 3s. 6d. per grain bag (say 20 lb.); 23s. 3d. per woolpack (say 150 lb.), and the same price obtains now. The number of seeds to a pound, when dry, is about 25,800 gross, and 20,000 net (matured)."

If Mr. Alston can supply seeds in this quantity, and at this price, four or five years after the introduction of this salt-bush to Cape Colony, surely some of our enterprising seedsmen can do the like for New South Wales. Cannot they specially bring the matter under the notice of their customers throughout the length and breadth of the land? It is to be

hoped that another season may not be allowed to pass without a special effort being made to replant large areas with this valuable salt-bush. I should think it would be an ideal plant to extensively disseminate in the vicinity of the artesian bores.

I give a few more of Mr. Alston's notes :—

"The seed may be sown at any time during the spring, summer, and autumn months; is not over particular as to class of soil, but prefers and grows most luxuriantly on moist, brackish patches.

"To sow the seed broadcast is very wasteful and unsatisfactory, the use of a spade or light hoe to lift the soil slightly, and inverting a thorny bush over the spot after sowing, is trouble well repaid.

"When the object in view is to make use of old and worthless lands, they should be ploughed but not harrowed. The seed should be sown in small patches (say, 50 yards apart), from half-an-inch to an inch deep, and well protected against sheep and cattle till the stem of the plant is too hard for them to eat. A light mulching of straw or similar material prevents too rapid evaporation, and in clay soils the pinching of the leader stem of the seedling. The spread of the bush on tilled ground is rapid; hence the advice to sow small patches, a foresight which enables the farmer to look after it better and use less seed and water.

"The plant stands drought, and a minimum temperature of 14 degrees."

The Old Man Salt-bush in India.—The following account of the experiments which are being made to introduce this most valuable plant into India will be found interesting. It is taken from the report on the Botanical Gardens, Saharunpur and Mussoorie, 1883-84, p. 8, as quoted in the "Dictionary of the Economic Plants of India," Vol. I, p. 350 :—

"The small plantation which was made last season continues to thrive. The plants are now from 4 to 6 feet high. They are remarkably healthy, and all of them are in flower.

"The genus *Atriplex* differs from that of *Chenopodium* in having the flowers unisexual, and in some species of *Atriplex* the flowers are not only unisexual, but diœcious, *i.e.*, some plants bear male flowers only, and others only female ones. The salt-bush is described in the *Flora Australiensis*, vol. v., p. 171, as diœcious. A few of the plants in this garden, are, however, distinctly monœcious,* clusters of the broad fruiting bracts being rapidly developed beneath the terminal racemes of the withered male flowers. This is so far favourable for supplying a more bountiful supply of seed for distribution from our own plants.

"Up to date 480 plants have been distributed, and about sixty are left in stock.

"Inquiries have been made regarding the condition of plants despatched from this garden to different places in India. Those sent to Cawnpore farm all died about two months after they were planted. Of the fifty plants sent to Mr. Ridley at Lucknow only two survived. These latter, he tells me, were planted out last November, and are now healthy plants, about 1 foot high, and with an equal spread. Mr. W. Impey, C.S., writing from Cawnpore in March last, says, 'The *Atriplex nummularia* plants of last year are thriving very well. Some of the bushes are 3 to 4 feet high, and I have taken many cuttings from them.' Fifty plants were sent to Bari Banki, and the president of the local committee informs me that they were planted in poor soil, where other trees and cultivation have hitherto failed. A few

* This is the case with the specimen now figured; also with other plants of the same species I have examined.

have died, and the remainder, though they have made considerable growth, are not thriving on the poorer soils, as the plant was represented to be likely to do. Mr. Dowie, the settlement officer at Kurnaul, reports favourably on the plants sent to him on the 31st December last.

"The salt-bush, being essentially a desert plant, should not be permanently transplanted until after the rainy season is over. This injunction applies more particularly to those parts of North-west India where the rains continue for any length of time. As soon as the plants have had sufficient time to establish themselves, no amount of rain is likely to injure them. If the seed is sown in pots during the hot weather, the seedling will be ready for transplanting in September or October."

Distribution.—This is the large salt-bush, which grows to a height of 10 or 15 feet, or even more. It is found between the Narran and Warrego, but hardly nearer in that direction, owing to droughts, over-stocking, and travelling sheep. It is an interior species, and no doubt at one time was found on enormous areas from, say, Moree to Wentworth. In many districts it is only represented by odd plants now. It is also found in the more arid parts of the colonies of Queensland, South Australia, and Victoria, and, as in our own Colony, it is driven further back every year.

Propagation.—One bush yields an enormous quantity of feed, and advantages of the plant are the ready way by which it may be propagated by its numerous seeds and by cuttings. The wood is exceedingly brittle, and therefore cattle readily break down a bush, but if the weather be at all favourable these pieces readily take root. Some of the lower leaves are very large, about 2½ inches across, and perhaps even more. It will stand any amount of neglect.

Reference to Plate.—The plant from which the drawings were taken is growing in the garden of Mr. W. A. B. Greaves, of "Braylesford," Bondi, who has successfully cultivated many indigenous plants. Mr. Greaves brought the seed from which this plant sprang from the Narran.

A, Portion of inflorescence, having both staminate (male) and pistillate (female) flowers, one third natural size; B, male inflorescence, natural size; C, individual male flower, magnified; D, female inflorescence, natural size; E and F, individual female flowers, magnified; G and H, fruits, with half of the fruiting perianth removed, magnified.

The Tree Tomato.

*Cyphomandra betacea, Sendtn.**

By J. H. MAIDEN
Consulting Botanist.

Vernacular names.—On the mainland of Central America it is known as the Tomato de la Paz, in Jamaica as the "Tree Tomato," and sometimes, on account of its supposed beneficial action on the liver "Vegetable Mercury." According to Dr. Masters, the fruit is occasionally seen in Covent Garden market under the erroneous name of "Grenadilla."

Botanical name.—*Cyphomandra*, from two Greek words signifying "club" and "anthers," in allusion to the club-shape the anthers assume. *Betacea*, like a "beet," referring to the general appearance of the leaves.

The tree tomato belongs to the Natural Order *Solanaceæ*, which includes the tomato, capsicum and potato, amongst edible plants.

Synonyms.—*Pionandra betacea*, Miers. *Solanum betacea*, Cavanilles.

Habitat.—The tree tomato is a native of the Andean regions of tropical America. It found its way to Jamaica, and it is to Mr. D. Morris, late Director of the Gardens and Plantations in that island, and now Assistant Director of Kew, that the credit belongs of distributing the plant throughout the world. For particulars as to its introduction into India and Ceylon I am indebted to an article in the *Kew Bulletin* for August, 1887, which also contains other interesting information in regard to this plant.

In Miers' "Illustrations of South American Plants," vol. I, page 39 (1850), the following account is given of the tree tomato, under the name of *Pionandra betacea*:—"This is doubtless the same fruit that I saw in the markets of Lima, where it is commonly used for cooking, in lieu of the ordinary tomato, the flavour of which it greatly resembles. Tweedie remarks that it is used in Buenos Ayres for the same purpose, but not ordinarily, for I never observed it. . . According to Cavanilles, this is a shrub about 4 feet in height." If this be correct as regards the size of the wild plant, it has increased largely under cultivation.

"The tree tomato was introduced to Jamaica many years ago, and it is sparingly met with on old coffee plantations, in the hills of St. Andrew and Manchester. It does not flourish in the plains; its range of elevation in Jamaica is from 2,000 feet to 5,000 feet, with a range of temperature from 72 degrees to 63 degrees F. It is found at Madeira and in the Azores, and is also cultivated in the south of Europe."

The Tree Tomato in India.—In 1882 seeds were sent to Madras for cultivation in the Nilgiris and other hilly districts of Southern India. In October, 1885, the first fruits of these plants were sent to Madras. "As Mr.

* Attributed to De Candolle in *Kew Bulletin.*

NOTE.—There is a *Cyphomandra betacea*, Miers, in Seem. Bot. Voyage, *Herald*, p. 174. It is now reduced to *C. hartwegii*, Dun., and must not be confused with Sendtn's species.

Morris, of Jamaica, stated in his letter to you in April, 1884, when he sent the seeds, it proved agreeable as chutney, fried, stewed, and in a tart, and may be useful for jam and jelly. In using the fruit the rind should be well removed, as it has a peculiar and disagreeable flavour; the pulp itself has a flavour of its own—pleasantly acid, not unlike the ordinary tomato, but more resembling the passion-fruit. The plants were grown in rather damp soil and standing close together. I removed them in September to different localities, but though full of fruit not one tree died or suffered. Flowering in May, the blossoms set well, and the fruits stood the monsoon better than I had anticipated, as only few of the fruits dropped, and some of the young trees bore over fifty. Now most of the trees show new flowers along with the ripening fruit, which may fully attain the size of a duck's egg." Later on, having noticed that an unfavourable impression had been produced at Madras respecting the growth of the plant and character of the fruit, Mr. Morris addressed the following letter to the honorary secretary of the local Agri-Horticultural Society, dated Kew, 6th July, 1886:—"I notice that in your report you do not speak very favourably of the tree tomato in Southern India. It is quite possible it may not be quite as good with you, as it undoubtedly is in the West Indies; but, on the other hand, it may be found, on larger knowledge and experience, to possess qualities which may commend it to general approval. The fruit should be allowed to fully ripen on the tree; this is an essential point as regards flavour and size. For cooking purposes all the seeds should be removed, and the outer skin. Then cut the fleshy part into quarters, and stew or cook as you would apricot or peach, or make into jam or jelly. If found too acid, steep in boiling water for a few minutes before using, and the flavour will be much milder. The planters in Jamaica attribute to it very beneficial properties as regards liver disease, and, indeed, my attention was first drawn to it under the name of 'vegetable mercury.' I cannot say anything about its medicinal properties, for I have had no opportunity to test them; but I can certainly speak highly of it as a fruit, prepared in the manner above described."

Mr. Charles Gray, of Coonoor, Madras, also writes:—"I notice in the annual report for the past year that the tree tomato is stated to have proved a failure in Madras as regards the flavour of the fruit. All I can say is that on the Nilgiris everyone that I have given a fruit to has pronounced it most delicious. . . . I write this as I for one (and there are many others here too), am decidedly in favour of its propagation, it being a valuable addition to our limited list of really tasty fruits, as well as being most ornamental."

The Tree Tomato in Ceylon.—In the report for 1884 of the Director of the Botanical Gardens, Ceylon, it is stated that "seeds have been received from Jamaica, and there are now many young plants at Hakgala." In the report for 1885, the Director says that "at Hakgala (6,000 feet), some of the tree tomato plants are now 11 feet high, and the fruits produced are very fine. They are egg-shaped, about 3 inches long, and 2 inches in diameter, and when fully ripe are of a bright yellow-red colour. They make excellent tarts, are very good stewed, and are much relished by most people when quite ripe and eaten raw, like gooseberries." In the 1886 report it is stated that the "tree tomato has spread rapidly through the hill country. The fruit keeps well after being gathered, and, as it has a tough skin and travels well, it might be largely cultivated in the villages for sale in the towns."

The Tree Tomato in Australia.—In the year 1884, Captain Murray, of the P. and O's. R.M.S. "Shannon," brought from Ceylon, in a 4-inch pot, a plant, about 4 or 5 inches high, of the tree tomato, which had been

attracting attention in Ceylon at the time. It is believed that this plant was one of the 1884 sowings by Dr. Trimen, from seed obtained from Jamaica as above mentioned, and therefore Captain Shannon's plant and the Ceylon plants were acclimatised together. The plant was presented to Mr. W. A. B. Greaves, of Bondi, and in eighteen months it fruited. In 1886 Mr. Greaves exhibited the fruit at a show of the New South Wales Agricultural Society, and was awarded a special prize for it. The newspapers and agricultural journals took the matter up, and Mr. Greaves informs me that he, in reply to requests, distributed seeds and plants in all the colonies, including the various botanic gardens. He has obtained large crops from tree tomatoes ever since 1886. Captain Shannon was also kind enough to bring a plant the following season to Mr. E. C. Merewether, also of Bondi, but I do not know to what extent plants were propagated from this. Anyhow, the tree tomato is thoroughly well acclimatised in Australia in four colonies, and no difficulty need be experienced by anyone who wants plants of it.

Flowers.—They are shown in the illustration, and are of a very pale purplish or rosy colour. When the tree tomato is in flower (and, in ordinary seasons, that is nine months out of the year), the flowers emit a delicious perfume, which is wafted a considerable distance. It is really sweet, and not sickly or offensive like that of a *Cestrum*. It closely resembles the perfume of *Pittosporum undulatum*. The perfume is particularly noticeable in the evening.

The Fruit.—If the fruit is allowed to fully ripen on the trees it may be eaten raw, and it has somewhat the flavour of gooseberry. If the skin is removed, and the fruit (without the seed), stewed with sugar, it resembles apricots, but with a slight sub-acid flavour, which is very refreshing.—*Kew Bulletin.*

The fruit is elliptical in section, about 3 inches long by 2 inches wide, and of a deep orange colour when fully ripe. The tree begins to bear in two years, and thenceforward, with care, it may be kept in bearing for a number of years. When once it begins to bear it yields fruit continuously for the greater part of the year.

The flavour of the tree tomato has been described by a number of people and opinions differ as to what amount of praise should be given to it. Even yet, it is new to Australians; in fact the majority of people have probably never seen it yet, much less tasted it. There is always a wide difference of opinion in regard to the palatableness of solanaceous fruits; for example, the ordinary tomato, which many people go into ecstasies over, cannot be endured by others, some of whom have tried, over and over again, to overcome their prejudice. Then again the Cape gooseberry is highly praised by some, and abhorred by others. I do not imagine that the flavour of the tree tomato will be appreciated by everybody. For my own part I like it much, but I could not eat it as often as I could apples, for instance. Mr. Greaves' family liken the flavour of the tree tomato to a mixture of pear and guava; to me it has a flavour which reminds one, amongst other things, of that of the rock melon; it, however, seems to have a flavour of its own, and hence, in trying to describe it, different people will compare it to different fruits. It may be used for dessert, but most people will prefer to make jam* of it, and it (in my opinion) makes a tasty conserve.

* Following is Mrs. Greaves' recipe for tomato jam:—Put the whole fruits into boiling water, and boil till soft. Peel off the skins and strain the pulp to remove the seed. Then, to every pound of fruit add three-quarters of a pound of sugar, and treat as for other jams.

(11046-94)

Cyphomandra betacea, Sendtn.

My advice would be for each person to try the fruit for himself, and I suppose it will be liked by most tomato-eaters. For the first three or four years, that is, before it gets scraggy, the tree tomato is quite an ornamental small tree in the garden, its large leaves adding pleasing variety to the garden. I am of opinion that it is a very useful introduction into New South Wales, though I scarcely agree with the rapturous (perhaps interested) recommendations I have heard in regard to it.

Size.—Mr. D. Morris, in the *Kew Bulletin*, refers to the tree tomato as "a large free-growing shrub or small tree, often attaining a height of 8 to 12 feet." Mr. Greaves' plants are all at least 12 feet high, and with a very large spread. They are simply loaded with fruit. On each tree were several hundreds, and it would be perfectly impossible to count them without plucking them from the tree.

A drawback to the tree tomato is the brittleness of its wood. After a few years it gets lanky, and then, being loaded with fruit and top-heavy, it requires careful staking and shelter lest it should be broken down by the wind.

Propagation.—From seed, which is to be obtained now from any seedsman. Mr. Greaves recommends it to be grown from cuttings, as it will bear fruit the same year (in as little time as three months), and makes a more compact tree, and less liable to be blown down by the wind than seedlings. Like many other solanaceous plants cuttings strike readily.

The plant figured was grown by Mr. W. A. B. Greaves, of Bondi, near Sydney, whose share in the acclimatisation of this plant in Australia has already been narrated.

Reference to Plate.—A, flowering-twig; B, bud; C, expanded flower; D, expanded flower as seen from above, the petals straightened out; E, flower opened out; F and G, back and front view of a stamen; H, pistil; J and K, longitudinal and transverse sections of fruit.

The Dorrigo Forest Reserve.

By J. H. MAIDEN,
Consulting Botanist.

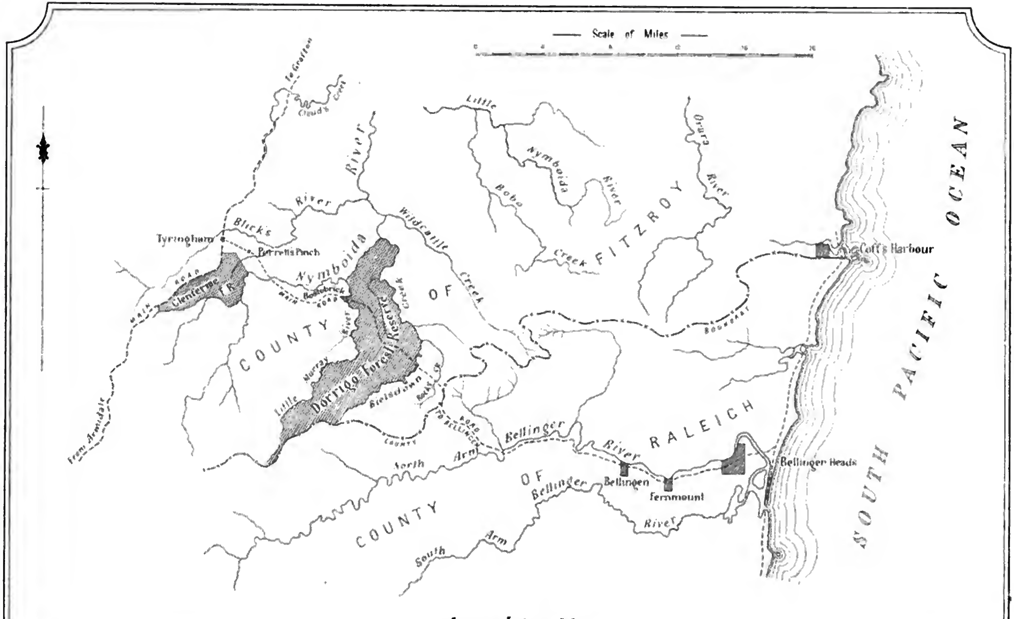
Part I.—A General Account of the Country, and how to get there.

The Dorrigo Forest Reserve is situated in the county of Fitzroy. It is bounded on the south-east by Beilsdown Creek, on the south-west by the range that divides the counties of Fitzroy and Raleigh, on the north-west by the Little Murray River, and on the north-east by the Nymboi River. It embraces an area of 23,880 acres.

A locality map is given, which will indicate its position, and may be useful, since very few maps contain any reference to it. The Dorrigo is a place of more than usual interest at the present time, especially in view of the proposal to throw its rich forest lands open to agricultural settlement. It is not my intention to discuss this subject; all I propose to do is to give some idea of the country, and subsequently to give an account of the vegetation. Dorrigo, or Don Dorrigo, is said to have been so called after a Spaniard or a Mexican who first found cedar on it. Local residents are not clear whether the gentleman's name was Dorrigo or Diego, or when he made his discovery, so here is a field for the Australian archæologist.

In the Dorrigo Forest Reserve itself I spent a week under canvas in December, 1893. The season of the year is not the best for the botanist; October would be better for the flowers, and March for the fruits. Nevertheless, I made copious notes of the vegetation, and also brought large collections of dried plants to Sydney. The lists, which will be given later, are of plants which I actually observed, and will form a basis for a flora of the Dorrigo. A number of plants were neither in flower nor fruit, and where the species could not be determined with absolute certainty, it has been omitted altogether. No plant has been put down on the assumption that it will doubtless be found in the Dorrigo; I have confined myself to actual observation. The area of the forest reserve being so large, and travelling, in parts of it, so difficult, I do not submit my lists as complete, but they will be found to be far fuller than any previous lists.

Access to the Dorrigo is obtained either *viâ* the Bellinger River, or *viâ* Armidale, or *viâ* Grafton. The North Coast S.S. Company runs comfortable steamers to the Bellinger Heads, 363 miles north of Sydney, once a fortnight, calling at Port Macquarie on the way. The trip usually takes about thirty-six hours. The fare is £2, or £3 for a return ticket. Having crossed the bar, the steamer lands passengers and discharges cargo at the village known as Bellinger Heads, and an interesting drive along the right bank of the



—— Locality Map ——
Shewing Dorrigo Forest Reserve & Surroundings.

PHOTO-LITHOGRAPHED AT THE GOVT. PRINTING OFFICE,
SYDNEY, NEW SOUTH WALES

Bellinger, first through forest country, and then amongst alluvial flats cultivated as maize farms, brings us to Fernmount (6½ miles), on a hilly situation, and commanding beautiful views of river scenery backed with hills covered with vegetation.

Soon after leaving Fernmount, the road passes over a hill (Marks' Hill). In the foreground is an extensive and well-planted vineyard (now somewhat neglected), and opening out before one is one of the most charming views of river scenery I have ever beheld. The artist will find many beauty spots on the Bellinger, and this is one of the chief of them. Regretfully leaving this "coign of vantage," we descend the somewhat steep hill, and thenceforward travel along a flat road until we come to Bellingen (10 miles from Bellinger Heads), a rising township better known under its old name of Boat Harbour. Here it is desirable to halt, for the traveller will, as a rule, find it most convenient to make a start for the Dorrigo in the cool of the morning, soon after daybreak. Leaving Bellingen (note the final "n"), there is an excellent road, following, in the main, the direction of the Bellinger River, and the eye feasts itself with views of exceptionally fine maize crops, interspersed with sweeps of river scenery. Near the road are small gullies or creeks filled to the tops of their banks with the richest vegetation, always green, and adorned throughout the year with a greater or less abundance of flowers, many of them of great beauty, those which are inconspicuous being frequently succeeded by showy or curious fruits. All around are vistas of well-wooded mountains, and we peer up at the huge mass called the Dorrigo Mountain, as our guide points out to us that part of the top of the ridge from which we shall strike out westerly.

About 10 miles after we leave Bellingen we find the Bellinger here a thin stream, though the great width of cobble stones and the traces of undermined banks very wide apart show clearly that the Bellinger at this distance from the sea is sometimes a very formidable river. We now begin a gradual ascent, and after a mile one sees a sign-post with the simple inscription "To New England,"—a reminder that we are fairly on our journey.

The ascent now begins in earnest. The old road, or rather cedar track, used to follow the ridges, and it seems almost impossible to contemplate how bullock-drays got up, and how the cedar logs (often sadly shaken and damaged), got down. The Government has recently completed a road up the mountain, which must have been a most serious undertaking, as much of it has been blasted out of a tough basaltic rock. There is just a little bit of excitement travelling up the mountain. The road is 12 feet wide, and there are some steep pinches and sharp turns in it. One side is often so steep that contemplation of it might make one feel giddy, and when one has passed a bullock-dray well loaded with cedar, one experiences, at certain bits of the road, a feeling of relief. A few days before our ascent a carrier lost some valuable horses through his cedar-dray going too near the soft edge of the bank, horses, dray, and cedar being hurled down the side of the mountain,—and with it the profits of cedar-hauling for twelve months at least. In the old days such accidents must have been far more frequent. Carriers have only had the luxury of this new road for about twelve months, and it has already caused some traffic to set in to the Bellinger, which previously could not have been thought of. It would have been a grand thing for cedar-getters on the Dorrigo Reserve years ago, but now the cedar on that reserve is practically cut out, and the last loads are being taken to market. Nevertheless, as will be seen later on, the Dorrigo contains many other valuable timber-trees, and sooner or later some of them will be regular articles of commerce. As we ascend the

mountain we have beautiful views of the valley of the Bellinger, and may see the sea far away in the distance. In the foreground is Billy McGrath's Hump, a huge mountain mass, clothed with trees to its summit.

Looking up and down the face of the Dorrigo Mountain, the vegetation is full of interest to the botanist and to other lovers of plants. As we ascended, the two showiest trees in the valley below were undoubtedly the flame-tree and the native tamarind. The former is certainly one of the most gorgeous trees in all Australia; for 80 or 100 feet in height it is a mass of bell-shaped flowers of the size of a thimble, and of a beautiful scarlet colour. The colour is not dimmed with the presence of a single leaf, for the foliage succeeds the flowers. The native tamarind is a most striking object, with its enormous bunches of orange-coloured fruit nestling in the handsome dark foliage at the tops of the trees, many of them nearly 100 feet from the ground. For the first few hundred feet of ascent we see tallow-wood, grey gum, red mahogany, a little turpentine, and other hardwoods. Passing these we find a profusion of brush-trees and shrubs up to the summit, never again seeing a gum-tree until we arrive at the "plains" in the Dorrigo. It would be mere repetition to enumerate the brush-trees seen along the mountain, but they are full of interest. One of the features of the vegetation is the great number of *Solanums* of varying size. The flowering shrubs are plentiful, interesting, and many of them beautiful.

Such is a cursory account of the vegetation one meets on one's way to the Dorrigo. Fuller details must be looked for in the list of plants which will be given.

Ascending the mountain, and contemplating the views at my feet and towards the ocean, I saw much to remind me of the views from the Bulli Mountain and the Sugarloaf Mountain, near Braidwood. The Dorrigo Mountain is bigger, and the views are on a grander scale than the Bulli. The Sugarloaf Mountain is beautiful, and I do not know how that scale of beauty is graduated which would enable one to put any other mountain scenery of the same character higher in the scale; but I am paying the Dorrigo Mountain what I intend to be a great compliment when I say that it is not inferior in beauty to the better-known Sugarloaf Mountain. I trust that some of our travellers, who seek in other colonies and in distant lands fresh scenes of natural beauty, will bear in mind the attractions of a trip up the Dorrigo Mountain, which may now be ascended and descended from Bellingen within the space of a long day.

When we are fairly on the top of the mountain (2,900 feet), after a journey of about a mile through rich chocolate soil, we cross Rocky Creek, and on the banks of it I saw for the first time the true beech of New South Wales (*Fagus Moorei*), of which I had heard so much,—a large tree, with dark, handsome foliage, of which I must have literally seen millions between here and Bald Hills Station (its most western locality), 65 miles from Armidale. We saw a few poor specimens of colonial pine (*Araucaria Cunninghamii*), coming up the mountain, but in the country past Rocky Creek, there are many fine trees, which are not at present utilised. The Bellinger is the most southerly locality for this species. Pursuing our journey, the country right and left of the road consists of almost impenetrable scrub, containing pine, coachwood, rosewood, sassafras, ironwood, and a host of less-known timbers, while the graceful little walking-stick palm (*Kentia monostachya*), is tolerably abundant, and locomotion in the scrub is rendered difficult by the prickly clothes-line stems of the Lawyer palm (*Calamus australis*) and the prickly *Rhipogonums*. Fine *Todeas* and various tree ferns are plentiful, as are handsome flowering shrubs on the skirts of the brush land.

After 2 or 3 miles of this road, we suddenly enter one of the "plains" or meadows, and are fairly in the Dorrigo.

The Dorrigo Forest Reserve consists for the most part of brush land, containing a great variety of timbers. In various parts are plains, which simply consist of grass-land, usually entirely destitute of trees, except a few specimen trees dotted about as in a gentleman's park. Usually the edge of the scrub and of the plain are as sharply defined as it is possible for them to be, as though a Brobdingnagian with mighty sickle, had there finished his reaping. The country is not by any means flat; it is usually undulating, and sometimes hilly. On the greater part of it, it would be difficult to find an area suitable and sufficient for a cricket match. In the forest itself there is almost perpetual gloom. The trees are so close together, are so tall, and have such leafy tops, that unless one keeps in beaten tracks, along which the timber has usually been felled, one rarely sees the sky, except an occasional glimpse obtained at the expense of a crick in the neck. There are many tracks in the forest, but most of them lead to cedar-pits, and a stranger to such country might pass from track to track for an indefinite period, and readily get bushed. To the untrained eye there seems but little diversity in the forest vegetation, and this would add to the difficulties of a stranger.

The arboreal vegetation of the Dorrigo consists entirely of what are known as "brush" timbers. Not a single species of Eucalyptus is found in it, though on the skirts of it (never penetrating beyond the fringe), is one solitary species of gum-tree, a white gum (*Eucalyptus viminalis*). To specify all the timbers of the Dorrigo would be far too tedious, but I may mention cedar, rosewood, tulip, ironwood, hoop pine, negro-head beech (*Fagus*), one of the silky oaks (*Orites*), sassafras, corkwood, marblewood, maiden's blush, and black apple. On the trunks of many of the trees, and particularly on the moisture loving *Fagus*, are innumerable individuals of orchids, ferns, and mosses, but I was disappointed to find that they consist of fewer species than I had expected. The charming Aroideaceous plant (*Pothos Loureiri*), is quite a feature in parts of the reserve, encircling most of the trees with graceful leafy girdles.

If scenery be desired, on the Dorrigo we have many choice spots. Near the south-eastern boundary of the reserve, the Beilsdown Creek, a considerable brook, and even a small river at times, throws itself over a ledge of rock some 60 feet high, forming a beautiful waterfall, known as the Beilsdown Falls. The water has excavated a deep basin, and the banks of the creek at this part form a deep gorge, while round the basin, and skirting the gorge, are ferns innumerable, the whole forming a very pleasing view. Another creek (Boggy Creek) no great distance away, also has a pretty waterfall, embowered with shady trees. The views of undulating country near Coghlan's, backed with well-wooded hills, are, in my opinion, simply charming, while the landscape, as one emerges from the dense forest, and looks towards the Little Murray River, with the Bald Hills in the distance, is so beautiful that I commend it to the attention of those of our artists who love to depict Australian scenes. This magnificent view gives me pleasure every time I view it with my mind's eye, and visitors to the Dorrigo could be promised other lovely scenes, though I cannot think of any finer than this.

According to all accounts, the Dorrigo is favoured with a singularly delicious climate. My visit was in December, but, while it was hot in the middle of the day, it got chilly at sundown, and one was always glad of a blanket at night. There is abundance of good water in the creeks, which I

am told are never dry. No observations have been taken in regard to the rainfall, which is, I should imagine, pretty considerable. On the adjacent coast there is much rain, Mr. Russell's report for Fernmount giving 98·69 inches as the mean annual rainfall, and the average number of rainy days in the year as 134. Records have been taken for three years only.

The Dorrigo is, without doubt, the sanatorium of the Bellinger Valley. Whatever the extent of the development of its agricultural and forest resources in the future, there is no doubt it is destined to become important to furnish cool, salubrious residential sites for jaded, anæmic dwellers in the heated valleys and coast lands. In the "plain" lands in the Dorrigo there are very many charming sites, either on land entirely denuded of timber, or possessing but a few trees, scattered here and there.

When we left the Bellinger for the wilds of the Dorrigo we could not truthfully say that we had not been solemnly cautioned in regard to the perils we were about to encounter from ticks, snakes, or leeches, or all three. But I do think the Dorrigo has been shockingly maligned. My duties took me into the most snaky-looking country, and I constantly had to fight my way amongst shrubs which are here and elsewhere always pronounced to be full of ticks, and I certainly had to go wherever leeches are most expected. But after a week in the Dorrigo brush (*vulgo* scrub), and two days in the Glenfernie brush, which strongly resembles it, my companion saw one solitary snake, known locally as "Bandy-bandy." This is the common ringed snake (*Vermicella annulata*); it is venomous, but has a mouth so small that it is only dangerous to insects. I afterwards saw an unfortunate black snake which had been run over by a bullock-dray—two snakes in all—a miserable record compared with what I have seen in parts of the Blue Mountains, for example. As to ticks, I would deny their existence in the Dorrigo, if certain people I know to be trustworthy, had not assured me that there are some. In any case I am afraid their number has been exaggerated, as is often the case in regard to statements concerning unfrequented country. With regard to leeches, I saw several specimens of a small species, but not a single horse-leech, a very different record to the country at the foot of the Bulli Mountain, for instance. In my tent I caught two mosquitoes, which had probably come up with my baggage. While I do not wish to generalise from my own limited experience, I may express the opinion that the Dorrigo is unusually free from animal pests.

The visitor who desires to get to the Dorrigo from Armidale, will find clean and comfortable country hotels at Wollomombi (28 miles), Guy Fawkes (50 miles) in the Snowy Range, and an hotel (Perrett's) at Tyringham (78 miles). So far we have been journeying along the main Armidale-Grafton Road, a very good road for the greater part, but at Perrett's we branch off. From the hotel we, for a mile or two, travel along a road as easy as that of a park drive, and then we come to a notorious bit of road known as Perrett's Pinch. The road for a few hundred yards is here simply the side of a rather steep hill, and every traveller is glad when he is over it. From thence the route, *via* Bostobrick, is mostly through rotten granite, and deep ruts and fairly steep pinches are common. Four miles from Perrett's we cross the Nymboid, which is often a formidable stream; 2 miles further on we leave Bostobrick head station on our left; and after 6 miles more we come to the Little Murray River, crossing which we are in the Dorrigo Forest Reserve. After a pleasant ride of a mile and a half through an undulating "plain" we enter the forest at the spot which I have above indicated as affording a lovely *coup*

d'œil. There is no made road from Tyringham to the Dorrigo, and travellers must expect to rough it. The distance is, however, as has already been indicated, only about 16 miles.

The Glenfernie Forest Reserve is about 20 miles north-west of the Dorrigo by road, and about 3 miles from Tyringham. Being so handy to the Armidale-Grafton Road, the cedar in it has been cut out long since, but it contains a good deal of Colonial or Hoop Pine (*Araucaria*), and there is a mill which is almost exclusively devoted to cutting pine from this reserve. This, I believe, is the most southerly mill in which this well-known pine is cut for commercial purposes.

The Dorrigo may also be reached from the Clarence, start being made from Grafton, along the Grafton-Armidale Road. The road is *viâ* Nymboida and Cloud's Creek, and after crossing Blick's River, one comes to Perrett's (Tyringham), and then branches off along the same road which would be traversed by a traveller from Armidale to the Dorrigo. The distance from Grafton to Perrett's is about 75 miles. The disadvantage of the Grafton route is its greater length, especially in view of the new road up the Dorrigo Mountain. The chief drawback to the Bellinger route is the uncertainty of the bar. Grafton is the metropolis of these parts, and my only regret is that I could not approach the Dorrigo both by the Bellinger and the Clarence.

In my next article I hope to give an account of the plants I found on the Dorrigo and adjacent country, laying stress upon such as are of economic value.

Botanical Notes.

By J. H. MAIDEN.

A Native Timber Suitable for Tobacco-pipes.

It has long been known that the timber of a small tree which grows in the arid interior is suitable for tobacco pipes. The botanical name of this tree is *Hakea leucoptera*, R.Br., and it belongs to the natural order Proteaceæ, which includes honeysuckles (*Banksias*), *Grevilleas*, and such plants. Its aboriginal name is "Ury," and because of the prickly nature of its leaves, it goes under the name of "pin-bush" and "needle-bush." Because good drinking water used to be obtained by the blacks by chopping its fleshy roots into short lengths, and standing them on end, it is known as the "water-tree," though it is by no means the only tree whose roots are employed for this purpose. Because of the colour and general texture of the wood it is known as "beef-wood," being one of many colonial timbers which possess that appellation. In appearance the timber resembles that of a number of *Banksias* and *Hakeas* throughout the Colony. The appearance is not easy to describe, but timbers of the *Proteaceæ* have a figure which is all their own, and which, when once understood, can never be confused with any other group of timbers.

Mr. Forester Kidston, of Hillston, in whose district a good deal of this western beef-wood grows, was asked to report upon it, and his interesting statement is best given in his own words:—"I have seen no place where a large quantity of it could be got within a small area, but it is very generally distributed over the timbered parts of my district. It is to be found in considerable quantities on Melrose and The Overflow Stations, also on Eremeran, Booberoi, Huabba, and Uranaway Runs. The latter is in the county of Blaxland. It is the root which has been used for making pipes, so far as my experience goes. Being a smoker, I can say confidently that it surpasses cherry, briar, or any other pipe I have seen. It is at best only a large bush, and only attains a maximum of 9 inches in diameter."

Many a smoker in the Lachlan country regards, with feeling akin to pity, people in other parts of the Colony where the beef-wood does *not* grow. The local manufacture of home-made tobacco-pipes must be great, and I have on several occasions been shown beef-wood tobacco-pipes which it was hard to realise had been made in the bush, and with rough tools. I understand that in Sydney at least one firm is engaged in the manufacture of pipes from this wood, so I hope that Australians who love a pipe will consider the expediency of giving this highly-recommended wood a trial. The wood has been extolled to me so often and so long, and by men whom I take to be judges of a pipe, that those who try it will probably be pleased with it. And now-a-days we must look after these little products and little manufactures. Great ironbark girders, huge turpentine piles, box decking, and so on, are

all very well, but in contemplation of the magnitude of the industries connected with our hard-woods, we must not neglect the small woods for special manufactures.

Tobacco-pipes are in various countries made of various materials, as fancy or necessity dictates, but in Europe two kinds of wood are of course most appreciated by connoisseurs, viz., the cherry and the briar (*Erica arborea*, Linn.), a corruption of the French Bruyére, or tree-heath, belonging to the Ericeæ, or true Heath family. Of this small tree the root is used for pipe-making, and enormous quantities are worked up in Tuscany (Italy), in Vienna, and other places. Of the beef-wood, I have seen pipes made of both the root-stock and the trunk. The former is probably the best, but to what extent, only smokers can say.

Noxious Weeds.

It is the intention of the Botanist to deal systematically and thoroughly with the important question of eradicating noxious weeds. In order to do this satisfactorily it is absolutely necessary to obtain authentic and wide information. For this purpose a few questions are appended, in the answering of which the Department feels confident of the cordial and prompt co-operation of pastoralists, agriculturists, and all others who take an interest in land matters, and that fresh samples combining flowers and fruit (seeds) will be forwarded with a view to having accurate illustrations prepared for publication in the *Gazette* in connection with the descriptive matter and recommendations which it is proposed to offer regarding them.

Following are the questions:—

(1.) What are the worst weeds in your district? Write them in order of obnoxiousness (send fresh samples of each).

(2.) State the bad points of the six worst at least.

(3.) Can you say when any of these weeds first made their appearance, and how?

(4.) What are the situations they most frequent? Are they spreading much, either in cultivated or uncultivated land?

(5.) Have any, and, if so, what, steps been taken for keeping them under control or eradicating them?

Name,
Address,
Occupation,

The Jerusalem Cherry.

Specimens of the fruit and leaves of a plant sent to the Department for identification, and to ascertain if the fruits are poisonous, have been identified by the Botanist as *Solanum pseudocapsicum*, Linn., commonly known as the Jerusalem Cherry. "The fruits are reputed poisonous," says Mr. Maiden, "but I cannot ascertain any case of poisoning by them. They are so very common in Sydney gardens that, if they are really dangerous, it seems reasonable that one should be able to definitely prove their poisonous nature. I have had a shrub in my garden for years, and various people warned me to root it up on account of my little children. I have invariably asked them their grounds for saying it is poisonous, but the reply has always been, 'I have always thought it was poisonous.'" Should any of our readers be able to give authentic information on this point, it will be gladly welcomed and published.

Phylloxera-resisting Vines.

By J. A. DESPEISSIS,
Consulting Viticulturist.

The wild American grape-vines comprise several tribes and numerous varieties, which have for the past twenty years been extensively experimented with, especially in France, in relation to their suitability as phylloxera-resisting stocks for the purposes of grafting the choicer varieties of European grape-vines.

As the result of extensive experiments, the few varieties of vines reviewed below have been found to answer the requirements of the several surrounding conditions met with in European vine-growing districts, and I would beg to recommend that seeds from these varieties be introduced from the most reliable sources available; and, although it is claimed phylloxera is not propagated through the medium of grape seeds, that on arrival, and to make assurance doubly certain, they should be carefully disinfected by the departmental officers by means of carbon-bisulphide fumes, and sown for subsequent propagation and distribution at the Department of Forestry's nurseries at Gosford, and also at the farm at Wagga Wagga.

Perfect authenticity of the seeds, and utmost precautions against any possibility of introduction of the phylloxera even through the seeds, would, in my opinion, be insured by requesting Mr. G. Foex, the Director of the Ecole Nationale d'Agriculture of Montpellier, France, to collect and forward to the Department, parcels of, say, 10 lb. each, of the best sub-varieties of *Vitis riparia*, *V. rupestris*, *Solonis*, *York's Madeira*, and *V. berlandieri*.

Vitis riparia.—By general consent, the palm is awarded to this vine, as a phylloxera-resisting stock, that combines all the requisites. The wide area of its geographical distributions in North America has, however, created local peculiarities of growth, which explain why it is that some individual importations from America are in greater favour than others.

The *V. riparia* (sp. *Fabre*) is considered one of the best of the sort.

Its chief points are:—The cuttings strike easily; they take the graft well. Numerous observations have demonstrated the fact that in the European vineyards which have been reconstituted by using it as stock vines, the time of bearing is singularly shortened, while the yield is more abundant than in the case of vines of similar varieties growing on their own roots. Its only shortcoming is that, in the case of some sub-varieties, the stock is sometimes more slender in growth than the vine it supports. In purely calcareous soils, like those of the Cognac district, for instance, some other variety, as, for instance, the *Vitis berlandieri*, should be substituted for it, as it is affected by a form of *chlorosis* caused by deficient nourishment.

It requires a soil fairly well balanced in the various elements of plant-food, and in this respect will be found a great favourite in most of the Australian vine-yards.

The *Solonis*, believed to be a cross between *V. riparia*, *V. rupestris*, and *V. candicans.*—To its first two parents it owes its immunity to the attacks of phylloxera, and to the last its remarkable aptitude for thriving in wet and marshy soils where most other stocks would die. Well adapted for heavy, clayey, and wet soils. From its last parent it derives a certain degree of susceptibleness to anthracnose or black spot, and must receive suitable treatment for that disease.

A most resisting stock for soils impregnated with saline substances.

The cuttings do not strike so easily as those of *V. riparia.*

York's Madeira.—Like the well-known Isabella, a cross of *V. labrusca*, but unlike that grape-vine well known all through Australia, one of the most phylloxera-resisting vines known ; may be said to be, as regards its habits of growth, an *anti-solonis*, in so far as it is much in demand for dry, rubbly soils, where *riparia* would thrive poorly. It grows, however, proportionately better in the richer classes of soil.

The cuttings strike well, but the vine is a slow grower, although once established and grafted it ensures regular and heavy crops of grapes for a very long period of time.

V. rupestris.—Like the York's Madeira, and although not claiming any close botanical relationship with it, is much sought after for poor, barren, and rocky soils; does well in sandy soils especially ; hence its American appellations of sand's grape ; thrives where *riparia* would starve. Like the York's Madeira, too, it is characterised by the slowness, but also by the regularity and completeness of its development. Rose varieties possessing the widest leaves are found the best.

V. berlandieri.—This variety, lately introduced from America, is proving the saviour of vinegrowers on the calcareous soils of the Cognac district, where hitherto every phylloxera-resisting stocks tried had succumbed to chlorosis.

I would caution intending vinegrowers against the use as phylloxera-resisting stocks of the Isabella and of the *V. californica*, as I am aware the name of these vines are wrongly associated in these colonies with those of phylloxera-resisting American vines, which would prove, if tried by them, a complete delusion.

V. californica is reported as a failure in the attempt at reconstituting phylloxera-stricken vineyards. It has been cultivated for a period of over ten years at the Agricultural School of Montpellier, where it was grown from seeds sent by Mr. Wetmore, of San Francisco ; it has always shown poor growth ; is very susceptible to the attacks of phylloxera and to those of fungoid diseases, such as the mildew, &c. It is also almost impossible to grow it from cuttings, as I have myself tested it last year at Rocky Mount, not a single one of those I put in having grown.

As vinegrowers must, in a great many cases, adopt such stock as are suited for their particular soil, it would be important for them to know which are those most suited, and I here transcribe the results of interesting observations quoted by Mr. H. Marès in his report on the questions submitted to the Minister for Agriculture in France for the year 1888 :—

The table shows the influence of good and of indifferent stocks on the yield of the same variety of grapes (*Aramon*, 8 years old), all grown under

similar conditions. The observations extended over a period of five years, and the results are given in kilogrammes for one stock of vine.

ROOTS FREE FROM PHYLLOXERA.

	Sub-variety.				
Riparia ...	Despallières	(good)	...	22 kilos, 750 grammes	Shows the influence of good or indifferent stocks of the same variety.
	De Las Sorrès	„	...	21 „ 670 „	
	Brazille	(bad)	...	10 „ 620 „	
Solonis ...	...	...	...	22 „ 366 „	
Berlandieri	...	...	...	20 „ 150 „	
York's Madeira ...	...	...	...	17 „ 607 „	

ROOTS SHOWING SIGNS OF PHYLLOXERA.

Tarquez	14 kilos, 681 grammes.
Cunningham	9 „ 977 „
Taylor	9 „ 800 „
Franklin	8 „ 781 „
Clinton	8 „ 324 „
Alvez	7 „ 932 „
Elvira	4 „ 903 „
Black July	4 „ 415 „
Rulander	2 „ 376 „
Clinton Violla	1 „ 800 „

Particulars of the steps taken by the Department in this connection will be found in "General Notes," at the end of this Part.

Wood Pavements in Sydney, 1880-1893.

Town Hall, Sydney, 31 October, 1893.

To The Under Secretary, Department of Mines and Agriculture,
"Forests."

Sir,—In compliance with your letter of 16th October inst., requesting me to compile a paper on the question of wood-paving, in order that the copies may be printed for distribution, I have the honour to submit the following for your information.

The first wood pavement in Sydney was opened for traffic in August, 1880; the section treated was that portion of King-street between George and Pitt Streets, and was simply an experiment to prove which class of timbers was the most effective.

First Method.

Before going deeply into these effects it is necessary to describe the methods that were employed in laying the foundation of concrete and thereupon the blocks, and perhaps the shortest course will be to quote from the specification the methods of execution, as follow:—

Laying Concrete Foundation.—The ground to be first well watered; on this lay a layer of wet broken stone, consisting of such of the old macadam as may be suitable, any further material to be of approved hard-stone broken to a two (2) inch gauge provided by the contractors; then spread a layer of cement mortar with a spade, and on the mortar a second layer of wet broken stone; beat this upper layer into the lower layer with beaters like large spades (made with one quarter (¼) inch sheet-iron about twelve (12) inches square, with straight handles). Another stratum of mortar, followed by a third of stone is then laid and the beating process continued, and so on until the required thickness of six (6) inches is attained. Then the surface is first beaten and finished by rubbing with the beaters to the proper convexity shown, the same being left quite smooth and regular. The mortar is to be composed of three (3) parts by measure of good clean river gravel, or approved stone chippings, to one part of best Portland cement. The entire proportion of the concrete when completed to be at the rate of four (4) parts of broken stone to three (3) parts of gravel and one (1) part of cement. When finished seven (7) days are to be allowed to enable the concrete to set thoroughly, and it must be inspected and approved before the blocks are set in the work.

Laying Blocks—Joints for Hardwood and Softwood Blocks.—These are then to be laid in rows transversely across the street on the concrete with the ends of blocks butting close, each row of blocks to be laid straight and regular to the proper convexity of the roadway, and to be spaced apart by

strips of well-seasoned and durable wood two (2) inches deep and one (1) inch thick in the case of hardwood blocks, and one and a half ($1\frac{1}{2}$) inches thick where softwood blocks are used.

Grouting.—When a sufficient area is paved the space between the rows is to be grouted to a height of two and a half ($2\frac{1}{2}$) inches above strips, with a mixture of clean, sharp, dry sand and tar, boiled sufficiently to abstract the light oils; this mixture to be made so that it will just run and make a thoroughly solid joint. The remaining one and a half ($1\frac{1}{2}$) inches to be flushed up to the surface of the blocks with cement grout, composed of best Portland cement, mixed with an equal quantity of clean sharp sand and fine gravel.

Finished Surface of Roadway.—When the grouting has set, the whole surface of the roadway is to be covered with a layer of clean coarse sand spread to a thickness of three-fourths ($\frac{3}{4}$) of an inch, and the traffic permitted to run over it.

Each Kind of Wood Separated.—The blocks will be supplied by the Corporation, and will be of various descriptions of timber. The contractor will be required to keep each kind of timber distinct, and lay them in separate lengths along the street, as will be directed. All the blocks are required to be of thoroughly sound well-grown timber of their various kinds, to be cut from the heart of the tree, and to be well seasoned and free from sap. Before being laid in the work the blocks and spacing-strips are to be steeped in boiling tar for the space of twenty-four (24) hours.

These extracts from specification, dated 8th August, 1880, are sufficient for description of wood pavements as then laid.

Timbers Used.—The timbers used in the work were of the classes known as red-gum, blackbutt, ash, box, baltic, blue-gum, brown pine, and cedar.

Removals and Renewals.—In January, 1885, about one-sixth ($\frac{1}{6}$) of the ash timbers were removed add renewed with spotted-gum and blackbutt. About one-tenth ($\frac{1}{10}$) of box, one-half ($\frac{1}{2}$) of baltic, one-quarter ($\frac{1}{4}$) of brown-pine, and all the cedar blocks were removed, and blocks of blue-gum laid. The remaining timbers were left in the work, and regarded as in fairly good condition. At the time of writing all the old blocks have been removed and the paving relaid with blocks of blackbutt and tallow-wood.

Wear of Different Woods.—The different timbers having worn as follows:—

Blue-gum	$\frac{1}{10}$	of an inch	per annum.	
Mahogany	$\frac{1}{8}$	,,	,,	
Turpentine	$\frac{1}{17}$	,,	,,	
Brush-box	$\frac{1}{7}$	,,	,,	
Spotted gum	$\frac{1}{7}$	,,	,,	
Baltic	$\frac{1}{10}$	,,	,,	
Colonial cedar	$\frac{1}{15}$	,,	,,	
Blackbutt...	$\frac{1}{20}$	,,	,,	
Colonial pine	$\frac{1}{25}$	,,	,,	
Blue-gum	$\frac{1}{15}$	,,	,,	(about).
Red-gum	$\frac{1}{10}$	,,	,,	

Spruce.—A few blocks of spruce were laid in King-street, and wore about one and a quarter ($1\frac{1}{4}$) inches, buckled and warped to an unshapely form, and split to destruction. This timber is very light, evidently not suited for wood-paving, and the City Council has discontinued its use beyond that laid in the first pavement in the city.

Spotted Gum.—The wearing surfaces of the blocks of spotted gum from King-street were thickly impregnated with gravel and extraneous matter, causing an irregularity of surface, the sides of the block in section showing a quick intention to split, the top edges of wearing surfaces were frayed over on each side for about one quarter (¼) of an inch in plan and section. Spotted gum is a treacherous timber to deal with, inasmuch that if the tree is not fully matured the blocks therefrom, painted with tar, laid in the work, enclosed air-tight, sap is prevented from escaping, and its fermentation sets up "dry rot." This has occurred in many instances, and as one block is attacked dry rot spreads throughout those adjacent. A sample block showing this decay is forwarded herewith.

Turpentine.—The block of turpentine wore uniformly, the wearing surfaces were uninjured, and the block otherwise sound.

Brush-box.—The brush-box did not show itself to be a sound timber for the purpose of wood-paving. The grain indicated a likelihood of warping and buckling. The condition of timber may be written as good for its class.

Length.—Another block of this timber, laid with close joints, examined after twenty (20) months' wear, showed a contraction of one-eighth ($\frac{1}{8}$th) of an inch in its length, and wore at the rate of one thirty-third ($\frac{1}{33}$rd) of an inch per annum. (Sample block forwarded.)

Colonial Cedar.—Colonial cedar presented a spongy-wearing surface for a depth of one-eighth ($\frac{1}{8}$th) of an inch. The block was perfectly sound.

Black Butt.—Black butt has worn evenly and regularly, and did not approach a sign of decay.

Colonial Pine.—Colonial pine had in several cases split obliquely across section following the grain.

Red Gum.—The upper surface of red gum was but little affected by traffic, except that jarring caused the edges to burr and overlap. The block was well preserved.

Blue Gum.—Blue gum showed a uniform wear similarly frayed at the edges, otherwise sound and not affected.

Mahogany.—A few blocks of mahogany indicated a thoroughly-good timber, even in wide-jointed pavements. The blocks maintained original shape.

Relaying old Blocks, 1-inch Joints.—For a time the works were under similar methods, and recently experiments have been made by taking up the old wide-jointed pavements and relaying blocks hammered up close on a cushion of tarred screenings and dust, flushing the joints with boiling tar and hot sand. The pavement so formed has been heavily and quickly travelled upon for about eight (8) months, and so far the result is good. The blocks so relaid had worn from half (½) an inch to two (2) inches. The cost of the work was about three (3) shillings per yard.

Reduced width of Joints.—Upon these facts the City Council considered it wise to reduce the widths of the joints as circumstances and conditions would admit, and accordingly I prepared a specification in which it is optional to lay the work either with close or one-quarter (¼) inch joints. Feeling satisfied that if wood pavements were laid in accordance therewith, I quote extracts (more particularly referring to the methods of preparing the foundation and laying the blocks) as part of this report:—

Foundation—No. 1 *Concrete.*—"1st. River gravel and coarse clean sharp river sand in suitable and approved proportions, the aggregate being mixed at least twice dry and twice wet, before being put into barrows. The gravel not to be larger than two and a half (2½) gauge, large pebbles to be discarded or else broken smaller. The concrete to consist of one (1) cask of cement

to twenty-four (24) cubic feet by measure of gravel and sand as shall be directed; or,

No. 2 Concrete.—"2nd. The aggregate may be composed of blue stone, free from all dirt and other materials, mixed with the dust and screenings obtained from crushings in the following proportions:—To one (1) cask of cement mix twenty (20) cubic feet of blue stone, broken from one (1) inch to two and a half ($2\frac{1}{2}$) inch gauge, and add fifteen (15) cubic feet of fine blue stone screenings and dust, composed of equal quantities of screenings not more than five-sixteenths ($\frac{5}{16}$ths) of an inch gauge, and dust obtained from the blue stone crushings. No foreign material to be introduced, and the whole of the stone screenings and dust to be perfectly clean and approved before use. The concrete to be prepared and mixed precisely similar to what has been previously specified for in No. 1 aggregate. The concrete is to be incorporated with not too much water, spread, and well consolidated by ramming to a total thickness of six (6) inches to the convexity indicated on drawing, varying as circumstances may require from 1 in 40 to 1 in 80. The concrete is worked up to a fine smooth surface and to the true convexity and the levels, so as to enable the floating, to be as thin as possible, and to form a homogeneous mass with the body of the concrete.

Floating.—"The top is to be finished off with a thin floating or rendering of fine stuff consisting of two (2) parts of coarse clean river sand free from all river gravel to one (1) part of cement, so as to bring the concrete to a perfectly smooth and uniform surface to receive the blocks, and finished off to a proper level and convexity; floating to be gauged with not more than thirteen (13) per cent. of water spread when and how directed. The work of laying the concrete and floating is carried on as speedily as possible, so as to render the entire mass compact. When finished at least seven (7) days elapse, so that the concrete will be thoroughly set. During this period the floating is, if required, kept moist and protected by means of damp sand or bags spread over its entire surface, to prevent its becoming dry or damaged by the heat of the sun. When this work is completed and approved the paving is carried forward with vigour."

Expansion Joint.—"A puddle of clean clay, two (2) inches in thickness, and to the full depth of the blocks, is placed between the kerbs and the wood-paving throughout the whole extent of contract." This allows for expansion that may follow rain and climatic changes.

Deep Kerbing.—This expansion joint is necessary, because when the blocks swell the kerbing and flagging are likely to be displaced. The City Council, to further remove this action, has increased the depth of the kerbing from twelve (12) to eighteen (18) inches, thus the block is pressing, as it were, against the middle third depth of the kerbing, and it is not probable that a displacement will follow; rather, however, that the joint will be forced up.

Size of Blocks.—"The entire area of the street is paved with wood blocks cut true and square in exact lengths of six (6) inches and thickness of about three (3) inches, and varying in width from six to nine (6 to 9) inches, which limit must not be exceeded except in the case of closures, when smaller blocks may sometimes be necessary." The blocks are laid on the concrete foundation three rows longitudinally against the kerbs throughout. The remainder of the blocks transversely or diagonally across the street to form an angle between thirty (30) degrees and forty-five (45) degrees or as otherwise directed to the convexity shown, the ends of blocks abutting against rows parallel to kerb to be neatly cut so as to form a close and even joint.

Quarter-inch Joints.—In laying a pavement with one-quarter (¼) inch joints the blocks are separated by bare quarter (¼) inch battens, that, upon completion, joints will not be of greater width than one-quarter (¼) of an inch.

Smooth Surface.—The joints are, so far as practicable, perfectly regular and uniform, and the blocks laid so as to form a smooth and regular surface.

Rows to break Joint.—Each row breaks joint not less than two (2) inches with half blocks properly sawn (not split) closing against longitudinal rows, the spaces between the rows to be regulated by means of planed batten strips bare one-quarter (¼) of an inch thick, to be drawn as each space is grouted, every care is taken to prevent the regular distances of the rows being altered whilst ramming.

Depth of Gutters.—The depth of gutters is regulated by circumstances, generally 6 inches below the top of the kerb, except where a change is advisable at intersections and other places to ensure proper surface drainage.

Diagonal Pavements at Intersections.—At intersections of streets or otherwise the blocks are sometimes laid diagonally, as before described. In such places where the blocks require it, they are neatly sawn so as to mitre closely at angles, and in all such cases meeting faces of blocks are well tarred or coated with wood-preserving oil.

Close Joints plugged up.—In pavements with close joints the blocks are dipped in or painted with boiling pitch and tar mixed in proper proportions and plugged up as close as possible.

Top-dressing.—The top-dressing consists of tarred pea gravel (free from dust), hard and not easily crushed. To gravel is added sufficient sand, prepared as for grouting, to cause it to bind and form a firm surface for the pavement.

Grouting.—In grouting the blocks are firmly fixed in position by pouring in coal-tar pitch mixed with fine grit to a depth of at least one (1) inch above the bottom of the blocks. The coal-tar pitch is melted in suitable cauldrons to just such a consistency that will cause it to set when cold as "medium pitch." When this is set the remainder of the joint is flushed up level with the surface of the blocks, with a grouting of tar, pitch, and clean, coarse, sharp, river sand (pea gravel of approved size is not objected to), mixed in such proportions as will admit of the agglomeration firmly setting within the joints.

Tar and Pitch boiled.—The tar and pitch is mixed well boiled, added to thoroughly heated and dry sand. The sand (and gravel if any be used) is heated in suitable warming pans.

Grouting Caulked.—The grouting is rammed and crammed into the joints until it is thoroughly solid for the whole depth of the blocks, thoroughly caulked with proper irons, and finished off with smoothing irons. On completion of the grouting the travelling surface receives a thorough coating of well-boiled tar sprinkled with coarse sharp river sand and pea gravel, or else fine blue stone screenings and tar. Where the paving is laid with butt joints it is similarly treated before the pea gravel is spread.

Joints Water-tight.—The tar and sand is well swept into all the interstices and sides and ends of the blocks so that the joints are rendered thoroughly water-tight.

Paint or Dip Blocks.—Ends or butt joints of blocks, as also the sides and bottoms, to receive a coating of tar laid on hot, either by dipping or by well painting with a brush, otherwise coated with wood-preserving oil. In my report upon city works carried out during 1892 I have gone carefully into

the wear of different classes of timber, laid in one or other of the modes hereinbefore described, and I have stated that:—

Wood-paving.—"The paving with butt joints is very satisfactory, and justifies the extension of the method in present and future contracts, provided, of course, that the gradient of construction is not too steep. Where this is the case, the blocks are laid with quarter-inch joints, and give almost equal conditions, save that the cost of laying is a little more. These close-jointed pavements have the advantages of being almost noiseless, easily cleansed and cheaply maintained. The pavement laid in the earlier days, with the wide joint, each year shows further causes that will ultimately necessitate removal. In this direction the Council has moved during the year, and a work of taking up and re-setting with butt joints the blocks of George-street, in front of the Town Hall, has been ordered, with a view of determining the practicability of treating the wide-jointed pavements throughout the city. The citizens have, from time to time, represented by letters, petitions, &c, the discomfort and inconvenience occasioned by noise of traffic upon wide-jointed pavements, and, no doubt, will hail with pleasure the Council's attention to their appeals; but in addition to this evil, the cost of cleansing and maintaining this class of pavement are disadvantages not met with in close-jointed work. Therefore it may be taken that, in the interests of public health and comfort, and for the cause of economy, and purposes of best construction, the wide-jointed pavements will be abandoned in works of the future, and removed from works of the past, in favour of that already described as económical, comfortable and most healthful.

Wear of Wood-blocks.—Upon examining blocks removed from George-street (which was opened for traffic in October, 1883), blocks of spotted gum were $4\frac{1}{2}$ inches deep, showing about $1\frac{1}{2}$ inches wear during $9\frac{1}{4}$ years, or at the rate of $\frac{1}{6}$ of an inch per annum; blocks of blue gum and grey iron-bark showed wear at the same rate. A concise description of each block examined and carefully measured, as shown in tabulated list of particulars here following, will be of value for future comparisons.

Block.	Name of street.	Width of carriageway.	Class.	Position.	Original depth.	Average depth on removal.	Average wear.	Date laid.	Date removed.	Rate of wear per annum.	Width of joint.
		′			″	″	″			″	″
A	George-street	79	Grey iron-bark.	20′ from E. kerb	6	$5\frac{1}{4}$	$\frac{3}{4}$	Oct., 1883	Dec., 1892	$\frac{1}{12}$	1
B	,,	79	Spotted gum	20′ ,,	6	$4\frac{1}{2}$	$1\frac{1}{2}$	,,	,,	$\frac{1}{6}$	1
C	,,	79	,,	18′ ,,	6	$5\frac{7}{8}$	$\frac{1}{8}$	,,	,,	$\frac{1}{73}$	1
D	,,	79	,,	24′ ,,	6	$5\frac{1}{2}$	$\frac{1}{2}$	,,	,,	$\frac{1}{18}$	1
E	,,	79	Blue gum ..	24′ ,,	6	$4\frac{3}{4}$	$1\frac{1}{4}$	,,	,,	$\frac{1}{7}$	1
F	,,	79	,,	18′ ,,	6	$4\frac{9}{16}$	$1\frac{1}{16}$	,,	,,	$\frac{1}{8}$	1
G	Pitt-street	36	Tallowwood	18′ from kerb....	6	$5\frac{3}{8}$	$\frac{5}{8}$	July, 1881	Dec., 1892	$\frac{1}{18}$	$\frac{3}{4}$
H	,,	36	Blackbutt ..	,, ...	6	$5\frac{1}{2}$	$\frac{1}{2}$	Jan., 1886	,,	$\frac{1}{14}$	$\frac{1}{2}$
J	Castlereagh-st.	36	Blackbutt ..	18′ from kerb....	6	$5\frac{13}{16}$	$\frac{3}{16}$	Jan., 1889	Dec., 1892	$\frac{1}{21}$	Butt joint
K	,,	36	,,	,, ...	6	,,	,,	,,	,,	,,	$\frac{1}{4}$ laid diagonally
L	George-street	64	Tallowwood	30′ from W. kerb	6	$5\frac{3}{8}$	$\frac{5}{8}$	Oct., 1883	Dec., 1892	$\frac{1}{15}$	$\frac{1}{2}$

"Thus showing the average annual wear of spotted gum laid with 1-inch joints grouted with tarred screenings (without regarding block C) to be about

one-eleventh of an inch per annum under fairly fast, heavy, and continual traffic. Under the same conditions blue gum may be taken as one-eighth of an inch per annum. Block B.—This block is evidently so much worn, because it seems to have been driven by the traffic through the floating, and by indentations ranging from $\frac{1}{4}$-inch to 1 inch on its base was bearing on the concrete. Block C.—This block, although only showing a wear of about $\frac{1}{8}$-inch (the block being 9 inches long at the top), was decayed for a depth of at least $\frac{1}{2}$-inch at the sides. I can only account for this decay by the absorption of water and extraneous matters which from time to time were collected between the joints to the said depth or perhaps more. I have no doubt that all timber laid upon roadways subjected to similar action would be in a similar state, if not worn to the extent herein stated. In the works referred to in Pitt-street, the blocks were laid with $\frac{3}{4}$-inch with boiling pitch poured in for a depth of 1 inch, then grouted with screenings and hot tar well caulked. In Castlereagh-street the blocks were simply dipped in hot tar, then laid and plugged close up to form a slape joint. The other blocks were laid with $\frac{1}{4}$-inch joints at an angle of 45 degrees across the carriageway. The examples quoted may be taken as the extremes and means. These figures enable me to give the wear of different classes of timbers, and it is decidedly in favour of blackbutt and tallowwood. For example, take the blocks of Castlereagh-street and calculate that Castlereagh-street has a 64-feet carriageway, being the same width as George-street, and then again, inversely take George-street as being the same width as Castlereagh-street, subjected to the same quantity and character of traffic, we will have then a wear of $\frac{1}{48}$th of an inch per annum, and taking George-street to be the same width as Castlereagh-street, instead of having the wear of $\frac{1}{16}$th of an inch per annum, the wear would be $\frac{1}{9}$th of an inch per annum, therefore wood-paving laid, all things being equal, save the width of joint, we have the $\frac{3}{4}$-inch jointed pavement compared with the close jointed pavement as $\frac{1}{9}$th is to $\frac{1}{48}$th, or approximately the life of the close joint pavement is about five times that of the $\frac{3}{4}$-inch joint. This computation is based upon the blocks J, K, and L. For another example we may compare the wear of the $\frac{3}{4}$-inch with the 1-inch joint, for this purpose I take example G and H (tallow wood and blackbutt respectively) and compared with the mean wear of A, B, D, E, and F. Take the average, and upon the assumption as the first calculation, the blocks would wear about one quarter of an inch per annum, if laid in a 36-feet roadway, quantity and character of traffic being equal. Taking case J, and comparing to the average in question, the wear per annum would be as $\frac{1}{27}$ is to $\frac{1}{30}$. Upon these figures the most suitable woods and best methods can be judged, the closer the joint the better the work if laid with tallowwood or blackbutt. My experience of spotted gum leads me to advise that the use of this wood be discontinued." Blocks of tallowwood and blackbutt laid with close joints showed wear during five (5) years of about one tenth ($\frac{1}{10}$) of an inch or at the rate of one fiftieth ($\frac{1}{50}$) of an inch per annum. The average number of vehicles quickly and slowly travelling over the streets from which the blocks have been taken is one hundred and eighty-six (186) per hour, and being mindful of the narrowness of our roadways, it will be easy to arrive at a judgment of the durability of the different timbers dealt with.

Summary.

First pavement and widths of Joint.—In the first pavement the width of joint was one (1) inch, this was subsequently and during a period of six (6) years reduced to three-eighths ($\frac{3}{8}$) of an inch, for by experience it became

apparent that the wide joint caused noise and slipperiness, and the action of the traffic bevelled and rounded edges of blocks to such an extent as to aggravate the two evils named. In 1887 complaints thereupon were numerous and of daily occurrence, hence many propositions to experiment in laying of wood blocks (by methods that had been patented before being submitted), none of which were however considered.

Experiments.—During the early part of 1888 the width of the joint was further reduced to a bare quarter ($\frac{1}{4}$) of an inch when grouted and thoroughly rammed, and, with a view of obtaining the best possible results in the paving of George-street North, provision was made for four different methods of laying and grouting the blocks.

Three-eighths Joint.—1st. The $\frac{3}{8}$ths joint grouted with pitch screenings and tar.

Butt Joints.—2nd. The blocks were laid with butt joints dipped in tar and hammered up close, and afterwards flushed up by sweeping boiling tar and Nepean River sand.

Tarred Felt.—3rd. The blocks were laid on a roofing of tarred felt jointed with strips of the same material and hammered close up.

Sand and Tar.—4th. Three-eighths ($\frac{3}{8}$) joints grouted with Nepean sand, tar, and pitch.

Slipperiness overcome.—This work was completed 5th July, 1888, and since that time in travelling thereon the noise is greatly reduced, and slipperiness is removed by the spreading of sand, which upon wood pavements becomes necessary on "greasy days," irrespective of width of joints.

Best pavement.—All things being equal, the most satisfactory is that laid without grout in the manner following:—The blocks painted on all surfaces with hot tar or wood-preserving oil (preferably with both), and stacked for at least four hours before being laid in the work. Every twelfth (12th) row hammered up close (a plank twelve (12) feet long, six (6) inches deep, and two (2) inches thick, being used as a beating surface. Upon completion of a length of one (1) chain, the surface well swept with hot tar, sprinkled with hot sand, and again with tar, sufficient quantity being used to form a plastic paste, with which the spaces between the blocks were thoroughly flushed up. If wood-preserving oil be used, the joints are flushed up with cement and river sand mixed in the proportion of two (2) of sand to one (1) of cement. Three (3) months' wear upon this section caused the joints to gape and to loosen slightly.

Remedy for Gaping Joints.—To remedy these defects the blocks were well watered, when fairly dry again the joints flushed up with sand and tar as before described, since which the pavement, even though it has been subjected to most variable influences, has maintained a most satisfactory condition.

Pavement diagonally across Roadway.—The work in Castlereagh-street, from Hunter-street to Liverpool-street (fifty-eight (58) chains), afforded opportunity for further experiment, and for a length of eight (8) chains, the blocks were laid at an angle of forty-five (45) degrees to the kerb, by which a wheel in its revolution is on at least two (2) rows of blocks, the noise occasioned by the jarring over the joint is thus very much reduced.

Close Joints Convexity.—In the same street a butt-jointed pavement was laid for a length of seven (7) chains, with a gradient of one in sixty-five (1 in 65) and a convexity of one in sixty (1 in 60). In my opinion, where the gradient does not exceed one in thirty (1 in 30), butt-jointed pavements may be laid with advantage; in such cases the convexity might also be reduced to one in eighty (1 in 80).

Expansion.—In this section to provide for the expansion of the blocks a seam of sand, one and a half ($1\frac{1}{2}$) inches wide, was laid on each side of the roadway, between the kerb and the blocks.

Effect of Traffic.—The pavement has been travelled upon for about five (5) years, and has not yet required any repairs or treatment.

Classes of Timber.—The woods used in these works were of the classes known as blackbutt, blue gum, spotted gum, and tallowwood.

Wood and Macadam.—Traffic upon a closely-jointed pavement does not cause as much noise as that upon a macadamised road, and in anticipation of slipperiness it is reasonable to suppose that it would be overcome by similar treatment as the wider-jointed pavement.

Use of old blocks.—During the years 1887 and 1888 portions of the areas wood-paved with the wide joint were repaved with blocks laid with narrower joints. The old blocks obtained from these areas utilised in the paving of lanes and narrow ways adjacent to wood-paved thoroughfares, the foundations being prepared with the best material obtained from the excavation of the former roadway bedded on a layer of sand three (3) inches in thickness, joints grouted with sand and tar. This is a profitable use for old blocks.

Steepest gradient.—The steepest gradient paved is one in thirteen (1 in 13), and for a length of about one (1) chain the greatest width of roadway is 275 feet, in portion of which there is also the greatest cross-fall, one in seventeen (1 in 17), necessitated to conform with tramway construction.

Wood and Stone.—In the earlier days of wood-paved roadways in Sydney it was customary to lay blue stone cube setts on a bed of sand, spread over a foundation of concrete at the intersection of streets, but after three or four years' wear it was found necessary, for the safety of the traffic, to remove the setts and pave with wood blocks. This afforded an opportunity for comparing the wear of blue stone cubes with that of wood blocks.

Rate of wear, B.S. Cube Setts.—A careful examination of the cubes removed from intersections, after having been subjected to traffic for various periods from five (5) years upwards, an average wear of one (1) inch per annum was shown, while wood blocks removed from Pitt-street, between King and Hunter Streets, opened for traffic during July, 1881, showed wear at the rate of one-sixteenth ($\frac{1}{16}$) of an inch per annum, while blocks laid with butt joints showed wear at the rate of one-fiftieth ($\frac{1}{50}$) of an inch per annum.

Timbers.—These rates are given upon general average, and the woods were of the classes known as blackbutt, tallow wood, and blue gum.

Life of wood pavement.—Upon these results, making full allowance for depreciation and contingencies, the minimum life of wood pavements, as at present laid, may be safely considered as about sixteen (16) years, or from three (3) to four (4) times that of cube setts, while the maximum life may prove to be of about fifty (50) years, provided that the blocks were of thoroughly sound timber.

Flushing Wood pavements.—By the courtesy of the Water and Sewerage Board, the City Council is permitted to flush all the pavements by stand pipe and hose service. By this means, allowing for all circumstances in operation as travelling, time taken in affixing stand-pipes to hydrants, and the contiguity of the respective areas to be watered, I have calculated that the whole area, wood-paved, could be thoroughly flushed, swept and cleaned by twenty (20) men in eight (8) hours. I am doubtful about the effects of flushing wood-paved roadways, its chief advantage being ease of cleaning. On the other hand, in Sydney streets buildings having been built much higher than the

width of the roadways, the sun's rays are not effective in drying the blocks, consequently there is a dampness and humidity that in some cases have set up a decay.

Climatic influence.—The climate of the Colony is not so favourable as that of other lands in assisting the preservation of timber. Here we are subjected to long spells of hot, dry weather, followed by heavy rains, and at times great falls in the temperature take place. These circumstances must have a prejudicial effect on timber, and have no doubt that in more moist and even climates our colonial timbers would have better advantages. Writing generally upon these operations as affecting all wood pavements—first, in case of wide joints, the grouting was scoured out to depths varying from half-an-inch to $2\frac{1}{2}$ inches. The blocks loosened and rocked under traffic. The narrow joints were not thus affected, but the soakage between the blocks seemed to soften the surfaces and round the edges to such a degree as would probably shorten the life of the pavement. A pavement properly laid, that is with close joints, can be well cleaned and easily maintained by a judicious watering (not flushing) and simultaneously sweeping.

Cost of blocks.—Blocks for these works were supplied under special contract, and the prices per thousand varied from six pound fifteen shillings and sixpence (£6 15s. 6d.) to nine pound seven shillings (£9 7s.)

Cost of wood-paving.—The cost of wood-paving, including excavation, &c., varies from about twenty shillings to twenty-five shillings (20s. to 25s.) per yard, according as the convexity in the roadway may necessitate more or less excavation.

Pavement with cement grout.—In conclusion I am not favourably impressed with the result of cement grouting; but where same is employed the blocks should be separated with three-eighths ($\frac{3}{8}$) studs, so as to form a triangular holdfast before filling in with cement grout. Taking one-quarter ($\frac{1}{4}$) inch or three-eighths ($\frac{3}{8}$) inch space as a case for treatment, it seems to me that either is not sufficiently wide to give a strong body of grouting, and moreover in hot weather there is danger of the mixture becoming weakened during operation. I am therefore diffident in qualifying this as one of the best methods of wood paving, and if it be employed the blocks should be thoroughly coated with wood-preserving oil, so that any deleterious effect of the cement upon the timbers will be neutralised. Such a pavement is likely to require constant attention in all changes of season.

Best form of pavement.—The best form of pavements where gradients will admit, is certainly that with close joints, and I believe that any of the following timbers would suit admirably for so paving roadways: Blue gum, red gum, blackbutt, tallow-wood, mahogany, and turpentine.

Soft woods, close joints.—I am also inclined to think that softer timbers laid in this manner would give good results, and shall at the first opportunity put them to the test. I have endeavoured herein to embrace all information that, in my opinion, is required to meet the purposes of your inquiry, and if I have omitted any I shall be honored with the privilege to supply. Trusting that that contained herein will meet the purposes intended.

I have, &c.,

R. W. RICHARDS,

Assoc. M. Inst. C.E., M.M. & C.E., City Surveyor.

Contributions to an Economic Knowledge of Australian Rusts (*Uredineæ*).

N. A. COBB.

CHAPTER X.

Improving Wheat by Selection.

We have shown how to produce a cross-bred wheat, and have called attention in a pointed manner to the characteristics of the varieties of wheat, as we now find them. We have shown how an experimental wheat plot should be prepared, planted, and cared for. Let us now imagine the crop to stand before us, and proceed to consider how wheat may be improved by selection, for be it remembered that it is always by selection that wheat is ultimately improved, and that upon the degree of skill shown in selecting, depends the amount of improvement we make. Cross never so skilfully, and then select badly, and the result will be unsatisfactory. To make a cross requires some degree of skill with the hands, and good judgment as to the kind of cross it is desirable to make. Selection requires qualities of a far higher order.

Wheat is grown in such a variety of ways, harvested and prepared for the market with such a variety of implements, put to such a variety of uses, ground in such a variety of mills, that selection becomes the result of a very complicated set of factors.

In this work we would very willingly avoid the consideration of these numerous factors, but we cannot. The problem before us, namely, that of reducing as much as possible the loss due to rust, is too closely connected with them to permit us to ignore them. In fact the reader will see as he goes on that it is these very factors that have more to do with our problem than any others.

The experimental wheat-plot stands before us, presenting a large number of varieties of wheat. Each variety is composed of plants nearly alike, but still no two are exactly alike. Among all the plants in the plot there is one that is best. How shall we find it? If we can but find it, and sow its seed, we shall introduce on our farm a sort of wheat that will yield us larger crops, give us better incomes, and help to reduce the price of the world's daily bread. Surely this is a grand problem to set ourselves to solve, one worthy of our best efforts!

In order to find and select the sort of wheat-plant, which, on the whole, is the best for us to grow, we must consider every factor in the growing, and in the manufacture into food-stuff. We must consider which plants suffer least

NOTE.—The fact that few of the laws that govern the result of a wheat-cross have been discovered, render good results largely a matter of chance. The best compensation for this disadvantage is the making of a large number of crosses. Out of a large number some good results are sure to follow.

from rust, and of such which yield the largest quantity of good grain. We have already given a scale by which the amount of rust on a given plant may be noted down for comparison with that found on other plants. The scale we believe to be by far the best yet contrived, and the only one with a definite basis, namely the area on the surface of the plant which the rust has succeeded in covering. Our 5 per cent. means that the rust has covered 5 per cent., or one-twentieth of the area of the plant or part examined. Our 10 per cent. means that the rust has covered 10 per cent. or one-tenth of the surface, and so on. Our scale is accurate, scientific. It is at the same time simple and easy of application. The method of application has been already described. It may be well to add that it is equally applicable to sheaths and straw. This is not so readily understood, but is clear at once when we state that the width of the unrolled sheath or straw is the same as, or corresponds with, that of the flag or blade.

The plants to be first selected are those most free from rust. If the experimental plot has been made as directed in the chapter on experimental wheat-plots, that is to say, with every other drill a very rust-liable sort such as Golden Drop, we may be reasonably sure that the plants most free from rust are those having rust-resistant, or rust-escaping properties. But it must never be forgotton that we cannot be absolutely certain of this. It may be that for some reason we do not know, a particular plant may escape being rusted, and yet possess no great power to resist rust. There is no more practical plan for guarding against this uncertainty than that we have advocated of sowing every other drill with a rust-liable sort.

At this point attention should be directed to the fact that some plants have a power to endure rust. It will be remembered that we proposed the terms rust-proof, rust-resistant, and rust-escaping, as descriptive of different kinds of wheat. To these three might be added a fourth, *rust-enduring*. A rust-enduring wheat is one which, though liable to rust, is able, notwithstanding the attack of the rust, to mature a fair crop of grain under ordinary circumstances. This term has a more limited and less certain application than the other three, but will nevertheless be found useful.

The close-reasoning reader may at this point remark that after all, then, the selecting of least-rusted plants is superfluous, since some that are rusted may, in spite of rust, yield better than those not rusted, being rust-endurers, and this remark would be pertinent were it not for the fact that rust-enduring wheats are, to say the least, uncommon, and that furthermore we know at best very little concerning them.

As to the time of the year at which to make observations on rustiness, it may be said that the time when the crop has begun to turn, and after the nature of the yield is no longer uncertain, is the best; but for reasons to be given later on, the amount of rust at all seasons is worthy of observation.

Having found and marked the least-rusted plants, we allow them to mature their grain thoroughly, meanwhile noting how the plants behave in respect to the weather. These considerations are very important, as will be understood at once when we point out that the weather may succeed in so breaking down a wheat as to cause loss in harvesting or cause it to shell so freely as to reduce the yield. When the grain is ripe the relative earliness and yield of the various plants is ascertained, also the nature of their growth as related to harvesting machinery as well as the quality of their grain.

It will be seen from the foregoing brief outline what a large number of things have to be considered before deciding on the best wheat. Let us now make a table of the various points to consider, and then treat each point in detail.

I.—Selecting plants free from rust or nearly so:—

1. Rust on the flag.
2. Rust on the sheath.
3. Rust on the stalk.
4. Rust on the ear.

II.—Selecting plants for prolificness:—

5. Stooling; number of heads.
6. Sterile spikelets.
7. No of grains in a spikelet.

III.—Selecting for shape of grain:—

8. Long grain.
9. Pointed grain.
10. Round grain.
11. Shallow crease.
12. Small grain.
13. Small brush.
14. Thick bran or thin bran.

IV.—Selecting plants that hold their grain up to be harvested:—

15. Weak straw.
16. Flexible straw.
17. Stiff straw.
18. Brittle straw.
19. Long and short straw.
20. Beards, at least at the end.
21. Shelling on account of weak chaff.
22. Shelling on account of brittle chaff.
23. Shelling on account of loose heads.
24. Shelling on account of leaning or pendulous heads.
25. Varieties with a red chaff.

V.—Selecting early, midseason, or late wheat:—

26. Earliness and tough cuticle.
27. Earliness and great glaucousness.
28. Earliness and small foliage.
29. Earliness and weak straw.

VI.—30. Selecting plants for shortness of time between earing (not flowering) and ripening.

VII.—31. Selecting plants for narrow erect foliage.

VIII.—32. Selecting plants for toughness of foliage.

IX.—33. Selecting plants for glaucousness.

X.—34. Selecting plants for hairiness.

XI.—Selecting shapely plants:—

35. Heads all at one height.
36. Heads ripening all at the same time.

Our table gives thirty-six points to consider. We shall take these in succession, and devote a short paragraph to each.

I.—Selecting Plants free from Rust or nearly so.

Under this head it is to be noted that wheat with a purple straw is almost universally more liable to rust. The so-called purple-straws are all very rust liable. Even among wheats that are more or less resistant to rust, as for instance the Fife wheats, those showing a tendency to purple straw are more liable to rust than those not showing that tendency. The Fifes, as a rule, have whitish or yellowish straw; if, however, a single plant or a strain of Fife shows a slight purple hue in the straw such plant or strain will usually present more rust than other Fife plants. We have also seen some reason to believe that velvet-chaffed fine wheats (*T. sativum*) are more liable to rust than those with smooth chaff. From this one might argue that if a degree of hairiness could possibly hinder the attacks of rust, it must be a greater degree than we see on any of our present velvet-chaffed sorts.

It will be noticed at once on proceeding to select plants comparatively free from rust that such plants occur more frequently among bearded varieties. Perhaps we might put it better by saying that bearded varieties are relatively freer from rust. There is, however, an objection to bearded wheat on account of the trouble it gives in threshing. We have made observations and experiments, which we shall present in a later chapter, which lead to the important conclusion that the beard of bearded wheat can be made to drop off in ripening, and therefore cause no difficulty in threshing.

1. *Rust on the Flag.*—It is a common saying that rust on the flag does no harm; but this is false. How any sensible wheat-grower can make such a statement is beyond our comprehension. Did he ever see wheat yielding 40, 50, or 60 bushels to the acre? And did he see any rust on the flag of that wheat? We are sure he would look a long time before finding much. Moreover, one of the very good reasons for the high yield of that wheat was the absence of rust from the flag. Had there been much rust on the flag the yield would never have reached anything like 40 bushels to the acre. One might as well say there is no harm in a horse having only a peck of chaff per day and nothing else. To be sure, he might live, but very little work could be got out of him; he would be about as profitable as rusty wheat at 7 bushels to the acre, and for the same reason, namely, lack of food. What is meant by the declaration that rust on the flag does no harm, is that as long as the rust is confined to the flag there will be *some* grain in the head. This is true; it is equally true that if there is no rust on the flag there will be very much *more* grain in the head, unless some cause that has no connection with rust prevents. We would like to point out, moreover, that every bushel per acre gained by absence of rust from the flag is clear profit, and that it is just such points as these that it is, now-a-days, the most necessary to consider. If there is no rust on the flag there will be none elsewhere. Let us abandon for ever this fallacy that rust on the flag does no harm. Does no harm! Why, the flags are an important part of the breathing system of the wheat plant, and, furthermore, furnish a considerable amount of its food! Would a man be just as well off with one lung, and half-starved? The idea is ridiculous.

If selection for a minimum of rust on the flag takes place among separate plants, then the operation is simply a comparison of the flags of separate plants with each other. In this case no scale of rustiness is absolutely necessary, but it will be found a great convenience. If, however, a large number of plants of one variety are to be compared with a large number of plants of another variety, then a scale of rustiness becomes an absolute necessity if accurate and valuable work is to be done. It is wholly unsafe to take a general look at one variety and then at another, and endeavour to

say which is the more rusty, if, as is very often the case, the two differ from each other by no more than 10 per cent. We have frequently done our very best to judge between two sorts under such conditions, afterward testing our judgment by actual measurement. We find that we judge wrongly as often as rightly. The difficulty is all the greater if any amount of time elapses between the two judgments, as in the case of comparing one season's results with another's. How much greater is the difficulty, therefore, in comparing one person's judgment with another's. These remarks on the necessity of a scale of rustiness apply equally to judging the amount of rust on the sheath and straw. The only scale yet proposed, which is based on an absolute unit, is that which proposes to express the amount of rustiness in terms of the area covered by the rust. This method is capable of being carried to any degree of accuracy whatever.

It is hardly necessary to point out that attention has often to be confined to the rust on the flag, especially among wheats that have been already worked a season or two, for the reason that the rust occurs nowhere else on the plant.

2. *Rust on the sheath.*—Judging the amount of rust on the sheath is similar in every way to judging it on the flag. Unroll the sheath and it has nearly the same width and appearance as the wider part of the flag, of which it is, in fact, a continuation. Rust is usually less abundant on the sheath than on the flag for the following reasons:—

a. The sheath is vertical, and, therefore, catches fewer spores.
b. It is more glaucous than the flag, especially than the upper side of the flag.
c. The cell-walls of its cuticle are thicker and tougher.

3. *Rust on the stalk.*—This is judged precisely like that on the sheath. One may easily acquire such facility in comparing the sheath and stalk with the paper rust scale as to make it unnecessary to split them open.

It is a matter of importance to note the kind of rust observed. An idea has been gaining ground that it is possible to dispense with a microscopic examination of the spores before deciding which rust is doing the damage, and we are sorry to say that we have been among those blamable in countenancing this idea. There is no absolutely certain way of distinguishing *Puccinia graminis* from *P. rubigo-vera* except by microscopic examination of the spores, and we have now abandoned every other. In its young stages *graminis* "spots" the flag in the same manner as the *rubigo-vera;* and in the later stages the *rubigo-vera* often "streaks" the stalk in precisely the same manner as the *graminis.*

If much rust occurs on the stalk, above the upper leaf, before the grain is filled, the grain will surely be pinched. The appearance of rust on the stalk, therefore, is a fact to be specially noticed.

4. *Rust on the Ear.*—This is a matter requiring little notice as no particular advantage is gained by knowing about it. It is customary with us, after having gone through a lot of wheat and determined what plants to throw out on account of their rustiness, to go again through the plot at once with a sickle, and remove all the discarded plants. This leaves the plot in better condition for the further selection of the best yielding plants, &c.

II.—Selecting Plants for their Prolificness.

The ultimate test of the prolificness of a plant is the weight of its dry grain. The weighing of large numbers of small lots of wheat is, however, such slow work that we often have recourse to other means of judging the

prolificness of a plant especially as there are some objections even to the method of weighing. We find that the ordinary spring-balance sold for weighing mail matter up to 1 lb. is most convenient for weighing the produce of a single plant. Remove the pan supplied with the balance, and put in its place a condensed-milk tin of the same weight and nothing better could be desired.

5. *Stooling.*—Good-yielding plants stool or tiller well, that is, produce a large number of heads. A single grain of wheat has been known to produce upward of 100 heads, but thirty to fifty is a very good number. Where a stool appears to have an unusually large number of heads, always look out that the stool did not grow from two grains instead of one. We have seen ridiculous mistakes arise from this source. If the stool be pulled up, and its roots be cut away with a knife, it is usually easy to see if all the stalks start from one grain or centre.

6. *Sterile spikelets.*—It is impossible to judge of the prolificness of a plant by merely counting the heads. It is necessary to know what grain the heads contain. One thing that reduces the amount of grain in some apparently large heads of wheat is the number of sterile spikelets, that is, spikelets at the bottom of the ear which contain no grain. The number of sterile spikelets may reach as high as six or seven. To have a large number of sterile spikelets at the base of its ears is, therefore, a bad quality in a wheat. The plant goes to the trouble of producing chaff, and puts no grain in it; this is waste of energy.

7. *Number of grains in a spikelet.*—This is a matter which determines more than any other the yield of a head of grain, but it is not a mere matter of number; the size of the grain must also be considered. The number of grains may reach five or six; commonly it is three or four. The uppermost grains are smaller than the others—sometimes very much smaller. Many wheats which produce but two grains to the spikelet are nevertheless good yielders, the two grains produced being large and heavy. A variety of wheat varies considerably from season to season in the number of grains produced by its spikelets. Grains sown from a head bearing four grains to the spikelet may give rise to heads with three grains per spikelet, and the reverse may also take place and a three-grain wheat produce four-grain progeny. The exact number of grains depends on the nature of the season, and the method of raising the wheat. If wheat be top-dressed with suitable manure at a time when the heads are first peeping forth, and rains follow so as to wash the manure into the ground, the heads will nearly always produce spikelets with a large number of grains in them. Where wheat is grown on a small scale in mixed farming this is a fact worth knowing, as with suitable means a small area of wheat can be top-dressed to suit the weather.

III.—Selecting for Shape of Grain.

This is a very important part of selecting, the guiding principle of which is the mathematical truth that a round or spherical surface is that which will enclose the maximum of space for a given amount of surface. Thus, a square inch of surface will enclose the most space if disposed in the shape of a sphere. The application of this principle to the grain of wheat is quite simple. We have to remember that the surface part of a wheat-grain is bran, and of little value as food, while it is the great bulk of the interior that is ground up into flour and other food-stuffs. The more nearly a wheat-grain resembles a ball, the less bran it will have in proportion to its flour, and, on the other hand, the more it departs from being round like a ball the

more bran it will have in proportion to its flour. From these statements it might be inferred that round-grained wheats are to be preferred, but it will soon be seen that the exact opposite is true, and that long-grained wheats are of the greatest value.

8. *Long grains.*—The value of a grain of wheat as a food producer depends on the amount of food it produces, and the nature of that food. Roughly speaking, the food is of two kinds—starch and gluten. The main portion of the interior of a wheat-grain is starch. Immediately under the bran however is a layer of gluten. Gluten is a nitrogenous food-stuff, as meat is, and it is consequently worth more than starch. From this it follows, roughly speaking, that the more gluten a grain contains, the more the grain is worth, providing the gluten is of the right sort. Since the gluten lies next the bran, and therefore near the surface of the grain, it follows that the greater the surface of the grain is in proportion to its bulk or weight the more gluten it contains, and inasmuch as long grains are those that depart most from the round or spherical shape, they are precisely the grains that contain the most gluten, other things being equal. Thus far the matter is comparatively simple, but complications arise in the following manner: While up to a certain point the gluten in a grain is first in importance, there comes a point at which it is necessary to consider the bran. For instance, let us imagine a grain of wheat to become as long and slender as a sewing needle, its gluten layer would be very large, but along with it, and everywhere covering it, would be bran, and the proportion of bran in such a long and slender grain would be so great as to reduce its value very much as compared with a shorter grain. This would not be the case if the bran were a mere mathematical surface having no thickness; but of course such is not the case, the bran having an appreciable thickness. As a corrolary to these facts, it follows that the thinner the bran, the longer a grain can be, and rise in value on that account; or, to put it in another way, thin-skinned wheats should be selected for longer grains than thick-skinned ones. It goes without saying that for centuries it has been an object to reduce the thickness of the bran or skin on the grain of wheat.

9. *Pointed grain.*—A little thought will make it clear that a pointed grain demands more surface than a blunt one to contain a given amount of food-stuff, and therefore will contain more gluten in proportion to its starch.

10. *Roundish grain.*—By a train of reasoning opposite to that given above, it can be shown that roundish grains give less bran to a given weight than grains of any other shape. Connected with this small amount of bran of course is less gluten, unless indeed the gluten layer is thicker than usual, which is sometimes the case with roundish grains. It follows that in selecting wheats yielding roundish grains careful attention should be given to the thickness of the gluten layer, and only those selected that have a thick layer.

11. *Deep crease.*—The general contour of a grain of wheat approaches more nearly to an ellipsoid of revolution than to any other simple mathematical figure, and in the sections immediately preceding it may, for purposes of rough comparison, be regarded as in reality an ellipsoid. In reality, however, it is divided nearly in two by a deep crease; it is, in fact, two ellipsoids joined together. The bran goes to the bottom of the crease; as does also the gluten layer. From this it follows that the deeper the crease the more there is both of bran and gluten, but the grain increases in value with the depth of crease, up to any extent yet known to occur.

12. *Small grain.*—The surfaces of similar solids vary as the squares of their diameters, but the contents vary with the cubes of similar dimensions, from which it follows that it is better up to a certain limit to enclose a given

amount of food material in two bran-husks than in one. Compare a large grain of White Lammas, for instance, with a small grain of Allora Spring. Let the White Lammas grain weigh as much as 2 grains of Allora Spring. Then the bran on the two grains of Allora Spring will be considerably greater than that on the one grain of White Lammas, and of course the gluten content of the Allora Spring would be greater if the gluten layer was equally thick in each sort, an assertion which we do not make. It is worthy of notice, though well known, that small-grained wheats give the greatest weight to the bushel

13. *Small brush.*—The brush is worthless as food. The less there is of it the better.

14. *Thick bran and thin bran.*—For centuries millers have selected wheat for thinness of bran. The thinner the bran the more flour the miller gets from a given weight of wheat, and hence the more profit he secures. This fact has served to call continual attention to the desirability of thin bran. Wheat has accordingly gradually changed, until now ordinary marketable wheat presents a bran thinner in proportion to the size of its grain than can be found on any seed of similar plants (grasses) growing wild. The millers' test for the amount of bran is the best of all, namely, the amount of bran yielded when the wheat is well milled. This test, however, is not applicable by the miller to a small quantity of wheat, a fair sized mill requiring, when running as usual, about 20 to 50 bushels of grain, in order to give a reliable return as to bran and other products. The only tests that can be applied to small quantities with satisfactory results we believe to be a microscopic examination of a cross-section of the grain. We made examinations some years ago that led us to this belief, and further observations have confirmed our first opinion. In a later chapter we give additional information on this point.

IV.—Selecting Plants that hold their Grain up to be Harvested.

15. *Weak straw.*—By weak straw we mean straw of such a nature that the weight of its own heads and foliage causes it to sink down, or lean over and fall down without breaking. To select against weak straw, allow the plants to stand until dead ripe, or even longer, and then harvest only from those plants that still remain upright.

16. *Flexible straw.*—Flexible straw, or that which bends under the weight of the heads and sometimes even allows the heads to hang down, is harder on reaping and threshing machinery than most other sorts, for several reasons. Though flexible straw is usually small, it is always semi-solid, or solid, at least near the top, and therefore it is not more easily cut, on account of its small size, especially by stripping machines. Flexible straw is more likely to become tangled than stiff straw and is therefore managed with greater difficulty, because it often presents itself to the machine in an oblique fashion. Binding is also a little more awkward where the straws are curved, as is usually the case when they are flexible.

17. *Stiff straw.*—The bad qualities mentioned under flexible straw are a sufficient explanation of why stiff straw is desirable.

18. *Brittle straw.*—Brittle straw is easily broken by the wind, and the heads that fall down from this cause cannot be harvested by machinery. Brittleness is usually caused by the straw being thin-walled.

19. *Long and short straw.*—Whether long or short straw is desirable depends on the market value of the straw and the facilities the farmer has for putting it up ready for the market. As a rule, in the Australian

colonies the straw is not a valuable product, and beyond doubt short-strawed varieties are to be preferred. There are several reasons for this. In the first place, long-strawed varieties shell more because their straw is usually flexible, and the heads, being high above the ground, are more knocked about by the wind. In the second place, the energy (down to a certain limit), which they use up in making straw would be more profitable to the grower if put into making grain. On the other hand, short-strawed varieties of wheat generally stand up erect and hold their heads erect (an advantage, as we shall see directly) and do not allow the wind to get so much purchase as to batter the heads about and cause the grain to be shaken out on to the ground. The best straw for a variety of wheat is a short stiff one of large diameter having rather thick walls.

20. *Beards.*—Beards on a head of wheat serve to prevent shelling by lessening the shock of impact against other heads when knocked about by the wind. This advantage is counteracted to some extent by their liability to become entangled with those of other heads. Where the heads are thick together, even a few prominent beards at the top of the ear only are an advantage in a gale of wind.

21. *Weak chaff.*—Weak chaff lets the grain fall out. It is thin and flabby, and when the ripe ear is struck smartly the grains fly in every direction because the chaff is not stiff enough to retain its hold on the grain. Weak chaff is the commonest cause of the great evil, shelling. Stiff chaff is usually white or yellow, and is commonly glazed on the surface; its colour is its own. Weak chaff is so thin and translucent as to allow the colour of the grain to show through; its apparent colour, therefore, is derived partly from that of the grain. Weak chaff, when not tinted with red, is usually very white and flimsy-looking; even when tinted with red its white parts where protected by overlying chaff is equally flimsy looking.

22. *Brittle chaff.*—This is a cause of shelling very distinct from the preceding. Brittle chaff breaks away from the ear too easily. Its attachment to the axis of the ear is easily broken, and when it falls away the grain goes with it. Wheats with a brittle chaff, when ripe and subjected to a few days of dry windy weather, lose all their grain, the top of the stalk being reduced to a mere zigzag.

23.—*Loose or open heads versus close or compact heads.*—An ear of wheat is said to loose or open when the spikelets composing it are separated from each other by a considerable distance. In close ears the spikelets touch each other. It is evident that the latter sort are less liable to shell, other things being equal. Each spikelet bears against and supports its neighbour, and this hinders the grain from easily escaping from its envelopes. Even varieties, with naturally weak or brittle chaff, may be wholly or partly prevented from shelling by this means. Loose heads catch more wind, and therefore are more knocked about in a breeze, and this is a disadvantage. From what we have just said it is evident that unless a variety has very stiff and firmly-attached chaff, selection to improve it must be directed towards giving it a compact head. It is doubtful if any advantage whatever results from a loose head.

24. *Leaning or pendulous heads.*—Heads which lean over or hang down are, of course, more likely to lose their grain than upright heads.

25. *Varieties with red chaff.*—So far as we have observed, varieties with red chaff are quite liable to lose their grain by shelling. There are a few marked exceptions however.

V.—Selecting Early, Mid-season or Late Wheats.

There is a great advantage in sowing wheats that vary as to their time of ripening. In these colonies preference will always be given to early and mid-season sorts. There is no difficulty in the way of selecting for earliness.

We only wish to warn against judging ripeness by the outside appearance of the ear. Judge always by the grain. The ears of some sorts appear quite ripe when the grain is still in the milk, while other sorts harden their grain almost before the ear has ceased to be green.

As selection will hereafter be largely directed toward earliness, we wish to call attention to three or four natural incompatibilities to which it will be necessary to give close attention.

26. *Earliness and a tough cuticle.*—The quick growth of early wheats naturally prevents the processes from being as thorough as in the slower growth of later sorts. This result of pure reasoning is confirmed by observations. The cuticle of early sorts is not as tough as that of late sorts, and this is the reason why early wheats are so liable to rust.

27. *Earliness and great glaucousness.*—Great glaucousness is found in late wheats, but rarely, if ever, in early ones. The reason is probably the same as that for weak cuticle, namely, that the quick growth of early wheats gives little time for the elaboration of the waxy covering that causes glaucousness.

28. *Earliness and small foliage.*—Early wheats have large foliage in proportion to their size. This, again, is in harmony with their quick growth. It will probably be useless to select early wheat for small foliage. If the plants with little foliage be selected the progeny will be later.

29.—*Earliness and weak straw.*—Another and often disastrous result of the quick growth of early wheat is weak straw. No early wheats have very strong straw, and the breeder of early wheats will always be obliged to give special attention to this point. The consideration of 26, 27, and 28 is sufficient to show why early wheats are so liable to rust, and it seems probable that in view of these facts, we must go in for earliness regardless of liability to rust, and not expect to get a wheat both early and resistant. As for the weak straw, that can doubtless be avoided by selection. There will always be a tendency towards dwarfness in early sorts. An attempt should be made to associate earliness with smallish plants, having large foliage and short internode, and especially a short stalk.

VI.—Selecting Plants for their Manner of Ripening.

30. *Shortness of time between earing and flowering.*—The decisive struggle between the rust and the crop takes place on the stalk, *i.e.*, the portion of the straw above the topmost leaf and below the ear. If much rust succeeds in finding a lodgment in that locality before the grain is matured, the ear is, as it were, strangled, or, perhaps better, starved. The grain, in maturing, draws its food from the leaves and straw below, and this food is passed up to it through the stalk. If, therefore, rust has already attacked and mutilated the stalk, the grain has great difficulty in securing its food. It becomes pinched. The stalk is first exposed to the action of rust after the ears first peep forth, and it remains exposed until ripe. Now, the shorter this time is the less chance there is of the rust gaining a footing on the stalk. It follows, therefore, that the shorter the period between the earing-out of a wheat and its ripening the better. Wheats vary greatly in this respect, and we are satisfied that there is abundant room for improvement of all our varieties in this respect.

31. *Heads ripening all at the same time.*—Some plants have a dawdling way of ripening their ears. Long after the larger and uppermost ears are ripe the others lag. This is a weak point, and should be selected against. Never use for seed the grain obtained from plants having this irregular habit of ripening. No matter how fine some of the heads may be, their seed can only give rise to plants having the same bad habits. We have observed this again and again.

VII.—Selecting for Narrow, Erect Foliage.

32. The virtue of erect foliage consists in the facts that spores are less likely to find a lodgment on such foliage, and that such foliage is associated with a tough and glaucous cuticle. The latter fact is the more important of the two. Erect foliage is usually narrow and thick for its width.

VIII.—Selecting for Toughness of Foliage.

33. Selecting for toughness of foliage resolves itself into testing the tensile strength of the flag. This is a matter that has occupied our attention for several seasons, and some of our most promising strains of our known varieties have been a direct result of this sort of selection. The matter has been so fully dealt with in chapter VI, that we need not consider it at greater length here.

IX.—Selecting for Glaucousness.

34. The nature and effect of glaucousness, as related to rust, have been described in chapter VI, and we shall therefore only briefly allude to the matter here. Plants which, when they are young, have a dark-green colour—that is to say, a dark blue-green, as opposed to a yellowish green colour—generally begin to acquire a white and waxy (glaucous) appearance as soon as they begin to shoot up. Such plants, on a dewy morning or after a rain, always have what little water has succeeded in clinging to them collected in large drops. They refuse to wet on account of the aversion which their waxy covering has to water. Water does not readily adhere to them. Such plants are more resistant to rust than they otherwise would be. Late varieties of wheat are more inclined to be glaucous than others. Glaucousness is usually associated with a tough cuticle.

X.—Selecting for Hairiness.

35. Hairiness, to be in any way a protection against rust, must obviously be of a greater degree than any known to occur on any part of the wheat plant.

XI.—Selecting Shapely Plants.

36. A model wheat plant should bear its heads as nearly as possible all at the same height. This uniformity in the height of the heads is an advantage at harvest time, as all harvesting and threshing machinery works to greatest advantage on even feed. Where heads are all of the same height they furthermore ripen all at the same time, and, as we have shown, this is an advantage.

This finishes our enumeration of the points that have to be considered in improving wheat by selection. The way in which each sort of selection is made has been also indicated. We have only to add a few words in reference to a systematic way of applying the different selections.

The time to begin the work of selection is while the plants are still entirely green, but are on the point of turning colour preparatory to ripening. There are special points that can be observed to advantage before this period, but on the whole the greatest good with the least labour can be accomplished at about the time specified, which occurs while the plants are in flower and a week or two afterwards. The plants that are compared with each other should be as nearly as possible of the same age. First of all the plants are selected for rustiness; then they are submitted to each test in turn somewhat in the order in which we have given them. The plants which fail to come up to standard are discarded, or cut out altogether. The plants which remain are used as seed the following season, and again improved until a quality is reached suitable for the market. The novice in this work will be surprised at the small number of plants he has left after applying all these tests, perhaps only a few out of a thousand, or even only one. But as he continues year by year he will be gratified by seeing a gradual change for the better in the quality of his experimental wheats, and as the best are used to re-stock the farm, the great good of having an experimental plot will come home to him with irresistible force.

As we have before remarked, we are advocating nothing new in principle. There are already farmers in all directions who have for years, as their ancestors did before them, practised the art of selection. We wish only to call attention to the fact that this matter of improving seed by selection is worthy of the careful attention of everyone who makes his living by raising wheat, and that the experimental plot, even if small and devoted to only a few or even only one variety, is a valuable addition to any wheat-farm. The prosperity of any wheat-grower will be largely in proportion to his heed to the facts we have enumerated.

If no one has previously proposed so precise and elaborate a scheme of selection it is simply because no one has before given the subject sufficient attention; the conclusions we have arrived at are only those which common sense would inevitably reach with a little patient observation and reasoning. We should, perhaps, have been a little less elaborate were it not for the fact that we hope also to secure the attention of specialists, or would-be specialists.

One thing we have perhaps not made sufficiently clear. It is this, that all selection should be made by plants, and not by heads. There is a common practice of going through a crop, and plucking the best-looking heads for seed. This is better than nothing, but it may easily happen that the large and fine head is the only good head on the plant from which it was plucked. Its seed, therefore, would tend to produce similar uneven plants to that from which it came. Obviously, the only way to secure good seed without failure is to give full attention to the *whole plant* from which it came.

CHAPTER XI.

Harvesting Experimental Wheats.

The harvesting of experimental wheats differs from ordinary harvesting on two accounts—first, the necessity for greater accuracy; and second, the smallness of the lots harvested. Where the crop exceeds half a bushel, ordinary methods are best; but where only a few ounces or pounds of seed are to be harvested, a number of methods are used which will be of service to those who are following the recommendations in the previous chapter.

The reaping is accomplished with a sickle where many consecutive plants in the same drill are to be cut, as, for instance, in thinning out undesirable plants. Our plan is to go ahead of the workman, and indicate by pointing the plants to be cut. The workman cuts and binds into sheaves. Where, however, marked plants here and there in a plot are to be harvested the better way is to employ a pocket-knife. The blade may be small. The stalk is cut just below the ears, and the crop is placed in a bag hung to a strap round the waist, as shown in the accompanying engraving. A label is placed in the bag, as well as tied on outside. It is unnecessary to add that the label should give any necessary specifications, such as kind, quality, date, &c.

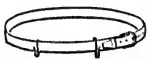


Fig. 106.—Strap and buckle to be used as a belt for supporting calico bags in harvesting experimental wheat. Two wire hooks are attached to the belt as shown in the figure, and upon these the bag is suspended, as shown in Fig. 107.

Fig. 107.—Showing the method of harvesting heads from selected wheat plants. The calico bag is worn as an apron attached to the belt, shown in Fig. 106.

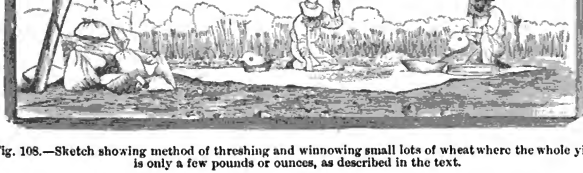


Fig. 108.—Sketch showing method of threshing and winnowing small lots of wheat where the whole yield is only a few pounds or ounces, as described in the text.

The threshing is accomplished by beating the bags containing the heads of wheat on a stone or plank, or by beating the bag with a stick, such as a piece of broom-stick.

The winnowing is done with a winnowing machine, if the grain measures half a bushel or more, but otherwise is accomplished in some other way. It is unnecessary to state that the machine must be scrupulously clean before commencing operations, otherwise the seed might become mixed. If the quantity to be winnowed weighs only a few pounds, it is first sieved in a common round hand-sieve, quarter-inch mesh. This is done on a large piece of canvas, which has been shaken free of seed. The grain is sieved into a large prospector's pan. If the wind is blowing, nothing further is necessary than to pour the seed shoulder-high from one pan to another to winnow it in a few minutes. If there is no wind, a pair of bellows will soon blow the chaff out of the pan, and leave the wheat winnowed. The seed may be sieved to secure the different sizes—or better, where the quantity is very small (an ounce or two), picked over by hand. The accompanying sketch gives a better idea of the operations than any amount of description. The work is facilitated if a very large movable table can be carried to the plot to lay the canvas on, so as to enable the men to work standing up.

The grain is best stored in bags—not in bottles, or it will soon lose its germinating power. The bags should be of good calico, and should be very

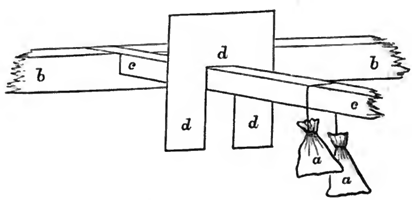


Fig. 109.—Contrivance for preventing mice and rats from getting at wheat hung over a rafter. *a a*, Small bags of wheat; *b b*, beam passing along the eaves of barn; *c c*, rafter; *d d d*, piece of sheet iron preventing mice from passing along *c* to the bags. Of course the other end of the rafter has to be guarded by another similar piece of sheet iron.

tightly tied at the mouth. The bags are best hung over a rafter or wire in the loft. We once saw at Mr. Wm. Farrer's farm an ingenious protection against mice, devised by him. It is explained in the adjacent figure.

Entomological Notes.

By A. SIDNEY OLLIFF,
Government Entomologist, New South Wales.

Bees-wax Moths.

The bee-moths, or bees-wax moths, of which there are two distinct kinds commonly found in Australia, are so well known, and have been so frequently figured and described, that it will not be necessary to give very detailed or technical descriptions of them here. A considerable number of inquiries have been received during the past two years regarding these destructive moths, chiefly from amateur bee-keepers; and it may, therefore, be useful to publish a few notes concerning the habits and seasonal appearance of these insects in Australia, more especially as I am able to add some information regarding remedial and preventive measures for the suppression of the pests which have been found satisfactory by experienced bee-keepers. The larger of the bees-wax moths—properly known as *Galleria mellonella*, Linn., but sometimes called by the name *Galleria cereana*, Fabr.—appears to be by far the most destructive of the two insects. It is a very widely-distributed species, being found throughout Europe and North America, in India, and even in the cold regions of Northern Siberia; indeed, it appears to have a range that is co-extensive with that of the hive-bee itself. In warm countries it is much more abundant, and therefore destructive, than in temperate or cold climates, a fact which is probably accounted for by the varying number of broods or generations which occur in a season under different climatic conditions. With us in New South Wales the first brood of moths appears in the early spring from caterpillars which have passed the winter in a semi-dormant condition, within the walls of their silken coverings, and only turned to pupæ or chrysalids upon the approach of warm weather. These winter or hybernating caterpillars feed very little, and usually confine their wanderings to the silken channels which they have made for themselves before the cool weather sets in. Upon the return of the desired warmth the caterpillars spin a complete cocoon for themselves and turn to the chrysalis stage, and in from ten days to a fortnight the perfect moth appears. The moth then lays eggs in any convenient spot, such as the sides and bottom of the frames, on the walls of the hive itself, or on the comb. In each case I have had an opportunity of observing the process, the moth chose the sides of the frames, as near to the brood-comb as possible, the young larvæ having a decided preference for this comb. The larvæ having once made their appearance, which they usually do in from eight to ten days after the laying of the eggs, their growth is exceedingly rapid, the average time before they are ready to assume the chrysalis stage being only some thirty days. The average duration of the chrysalis period is about a fortnight, so it can easily be seen with what great capabilities for

rapid reproduction we have to deal. As we have said, the number of generations, or broods, which develop in a season, *i.e.*, between early spring and late autumn, varies with locality and climate, but it may be worth while to record that, in my opinion, we have sufficient evidence to prove the existence of four broods in the Sydney district under ordinary circumstances. I have myself successfully bred three generations or broods from a comb received in early spring from the Richmond River; and I am convinced that a fourth might have been bred from the same stock but for an unfortunate accident to the eggs obtained from my third brood. Upon first hatching, the larva is pale yellow in colour, with a slightly-darkened head; and when full grown, is of a dull greyish flesh colour, with a dark reddish-brown head. Its average length is about an inch, and like the majority of the caterpillars of moths, it has sixteen legs. The chrysalis of the larger bees-wax moth is of the ordinary type, and it is enclosed in a very compact cocoon of tough white silk, usually spun up in one of the silken channels or galleries made by the larva which we have previously referred to. The perfect insect or moth has reddish brown-grey forewings, which are distinctly lighter in colour towards the outer or hinder margins. The sexes may readily be distinguished by the outline of the wings, as will readily be seen by a glance at the plate accompanying this article.

The second species of bees-wax moth is known as *Achrœa grisella*, Fabr., the lesser bees-wax moth, or honey moth, &c. Although not nearly so destructive as the larger kind, it does considerable damage in old and neglected hives. The moth is much smaller than *Galleria mellonella*, with which, by the way, I have found it associated in the same hive on more than one occasion. It is of a dead grey colour, with a yellow head. This species is not nearly so particular in choosing its food as the former kind (*G. mellonella*), and may frequently be found feeding on the *débris* which commonly collects on the bottom of a neglected hive.

In an article by Mr. W. W. Smith, published in *The New Zealand Country Journal* (vol. XVIII, p. 13, 1894), the following observations occur, and we venture to quote them here, as they appear to give some valuable information regarding the remedies for the attacks of these moths. Mr. Smith says:—
"In suggesting means for the suppression of the pest (the lesser bees-wax moth), it is important, as already stated, to put swarms into sound boxes, and to fit them closely on their boards or staging. The entrance to the hive should not be made too large, but just sufficient to enable the bees to pass to and fro without overcrowding. These precautions lessen the chances of the moths gaining access to the hives. It is advisable not to put the swarms into too large boxes, as any vacant space in the hive enables the moths to fly about, and also lessens the chances of their destruction by the bees. Another important matter is to examine the boards occasionally, and should any caterpillars or chrysalis be found thereon to replace them with clean boards. These remarks apply only to ordinary bee-keeping in plain boxes, such as is practised about farm homesteads and in the gardens of artizans. Should the foregoing hints fail to keep the moth in check, I would suggest that any hives becoming badly infested with the pest be destroyed with sulphur, and, after straining the honey, to carefully burn every particle of the comb. In badly infested hives the comb becomes impure, and frequently smells strongly when the box is raised off the board. To be able to obtain a supply of pure honey in future, stringent measures should certainly be adopted at the present time to check the ravages of the honey moth. The use of bar hives, and carefully attending to them for a few seasons, would practically annihilate the pest. The interest, however, in bee-keeping is not

BEES'-WAX MOTHS.
(Galleria melonella and Achrœd grisella.)

so general as to expect this to be done by ordinary bee-keepers. It is, nevertheless, regrettable that this pest should be allowed to increase, when a little attention and care for a few seasons would exterminate it."

From the foregoing account of the habits of these moths it will be gathered that remedies are not difficult to find. They may be briefly summarised as follows :—

a. Cleanliness; and to attain this frame-hives are essential. Every larva and every cocoon must be destroyed when found. Mr. W. Abram, an excellent local authority on bee-keeping, says, "Take out every comb and give the frames a gentle tapping with a small stick, when every grub will hasten to get out of its hiding place as quickly as possible, and will drop off, when it may be killed. Now with a knife, or other pointed instrument, pull out the cocoons, clean everything, and replace the frames."

b. Stored combs must be closely watched, and, if found to be infested, fumigated with sulphur.

c. Lantern traps, such as are ordinarily used by moth-collectors, have been recommended for trapping the perfect moths, but I doubt if they are worth the trouble which they entail.

It is a well-known fact that the beeswax moths do not attack the Italian or Ligurian bee to any serious extent; indeed they are rarely attacked at all. It is the ordinary black bee or hive bee that suffers so greatly.

In conclusion, I would express my thanks, amongst other kind correspondents, to Dr. Dagnell Clark, the Rev. John Ayling, and Messrs. Abram and Riddel, who have been kind enough to forward to the Department specimens or information.

As far as I am aware very few recognisable figures of the bee-moths have been published, so that the plate attached, from the pencil of Mr. E. M. Grosse, will, doubtless, prove very acceptable. With the exception of an excellent wood-cut in Dr. Taschenberg's "Die Insecten" (Brehm's Thierleben, vol. IX, p. 432) of the larger species, I have not been able to find a figure showing the stages or habits of these moths.

EXPLANATION OF PLATE.

Bees-wax Moths.

Fig. 1.—Larva or caterpillar of Larger Bees-wax Moth (*Galleria mellonella*, Linn.), side view (much enlarged).
,, 2.—The same viewed from above (much enlarged).
,, 3.—Cocoon of same, extracted from bee-comb (enlarged).
,, 4.—Larger Bees-wax Moth (*Galleria mellonella*, Linn.), male (much enlarged).
,, 5.—Forewing of same, female.
,, 6.—Larva or caterpillar of Lesser Bees-wax Moth (*Achræa grisella*, Fabr.), side view (much enlarged).
,, 7. Pupa or chrysalis of same (much enlarged).
,, 8.—Lesser Bees-wax Moth (*Achræa grisella*, Fabr.) (much enlarged).

In the back ground, above, a comb from a frame-hive is represented, showing brood-comb tunnelled by the larvæ of the Larger Bees-wax Moth (*Galleria mellonella*, Linn.)

The natural sizes of the insects are indicated by hair-line.

Report on Investigation of Bee Diseases at Campbelltown*.

By R. HELMS,
Department of Agriculture.

Sir, W. S. Campbell, Esq., Department of Agriculture.

I beg to hand you the accompanying report concerning the bee diseases, the investigation of which I had the honor to be entrusted with.

Whilst, I may say, that my experiments have produced a fairly satisfactory result, I must at the same time submit that upon several points my conclusions may not prove permanently tenable, because they are to a great extent speculation and deduction. This is due to the uncertainty which still exists about the origin and cause of at least one of the diseases, and will require a thorough scientific investigation before a definite conclusion can be arrived at.

The time at my disposal necessary for the experiments was scarcely sufficient, considering that they had to be carried out with caution on account of the lack of knowledge regarding the cause of the diseases. And besides that, it must be taken into consideration that bees cannot at all times be handled to advantage either to the operator or, more particularly, to that of the bees themselves. Cold, damp, and windy weather, or even an overcast sky will often make these insects very irate, and fighting and robbing may be encouraged if they are sprayed under such unfavourable conditions; or the temperature of the hive may be reduced by the operation so that the welfare of the brood may be endangered. Unfortunately frequent changes of weather impeded me to a great extent; and being well aware that under different conditions probably quite different results may be the outcome of certain experiments, I must not omit again to point out that, although my experiments have proved successful, further investigations are still necessary, and may lead to yet better and more decided results.

The anxiety of many bee-keepers to ascertain the outcome of the experiments induced me to report at the present time as fully as I am able, but in laying my observations before you, I am respectfully requesting you to consider the same by no means as finally completed, but merely as a good step forward towards the proper handling of the trouble.

I have, &c.,

Sydney, 13th February, 1894. R. HELMS.

* Note.—In a communication addressed to the Department, Mr. Kitching of Campbelltown, at whose apiary the above experiments were carried out, states that as a result of Mr. Helms' efforts the diseases have been completely stamped out.—Ed.

Bee Diseases.

Bee Paralysis.

Description.—The premonitory symptoms, if there are such, of this disease are imperceptible to the human eye. As a rule, it is only recognised when it has already reached an advanced stage. At this time a considerable distension of the abdominal parts of the bee takes place. The rings and plates become separated, so to say, and the intervening membranes are often stretched to such an extent that the movement of the joints becomes impossible, and the whole part below the constriction of the body appears as if ready to burst. The insect has now lost the power of using its limbs in the normal manner and staggers slowly about with generally one or both hind legs dragging, and at times rolls over,—as if drunk. Attempts to fly become futile, and result in short misdirected rises and frequently in a tumble only, but mostly the nervous vibrations of the wings are entirely powerless to lift the bee from the ground. The entire loss of power to use the sting is characteristic, and a still more advanced stage of the disease manifests itself by the increasing loss of command over the limbs; the front legs as a rule remaining active the longest. Ultimately the insect falls over, and, after a few hours, dies. No doubt the temperature considerably influences the protraction or acceleration of the death, but generally for an hour or two after the bee has fallen over the intermittent twitchings of the bag and wing muscles still indicate that life is not quite extinct. Almost invariably the bees die with their tongue protruding full length.

The intestines of the swollen bees are filled with a yellowish green liquid mass of fæcas, containing a good deal of pollen, which seems to a great extent to be the origin of its colour. Its odour is acrid and unpleasant, resembling the smell of cat's urine. Large numbers of various kinds of micro-organisms can at all times be found in this fluid mass, some of which are also found in the blood and in almost every part of the body.

The old bees as a rule suffer more severely from the disease, and those that succumb to it are found to be principally foragers; but I have also seen quite young bees, and even such as have only just been hatched, die off. This, however, I noticed more particularly to be the case in very reduced colonies.

Probably the development of the disease may extend over a considerable time before if becomes so virulent that it can easily be detected by the human eye; but whenever it approaches that stage it ends fatally to the bee within three days.

The Depilating Disease.

Description.—The bees suffering from this disease are easily recognisable by their appearance, as they become glossy and almost greasy-looking when it advances. This and their somewhat reduced size at once distinguishes them from the other bees of the colony. The gloss is due to the loss of the hair of the abdomen, as well as that of the thorax; but the abdominal parts seem to lose the hair first. Most likely the disease is the primary cause of the hair coming out, but it is doubtless promoted through the rubbing the bees get in the hive, and during the tussle they are subjected to during their ejection from the hive and afterwards. The glossy appearance may however to some extent also be attributable to a secretion of a fatty substance or moisture, because it often looks as if the sick bees were perspiring. When seen in

the hive they generally crawl slowly about the frames and at the bottom of it. They evidently have become too languid to fly out for the purpose of gathering food, and live upon the stored supply of the community. This behaviour is resented by the other bees, and consequently the sluggards are driven out; but probably many, feeling their death approaching, leave the hive on their own accord.

In front of the hive of a diseased swarm a number of hairless bees may always be found loitering on the alighting board when they are very often vigorously attacked by the healthy bees. These tumble over and over with them, and drive them away from the entrance. Occasionally two attack the same diseased bee, but generally only one takes the office of removal. A considerable number are carried away on the wing to a great distance from the hive, and probably not dropped till the carrying bee becomes tired. I have followed some of these pairs with my eyes to a distance of over 200 yards, and could never see the diseased bee being dropped. Dead specimens are also carried away to a large extent, which is not a very difficult task, as the dead soon dry and become light; a great number however remain lying about the hive when the death rate is large. I have noticed frequently diseased bees flying away, but I never saw one coming to the hive laden with pollen or honey.

During the warm time of the day a constant turmoil is noticed in front of the hive of a badly diseased stock, which, at first sight, resembles robbing to a great extent, more particularly so, because two apparently different kinds of bees are engaged in the contest. The shining appearance of the one kind, however, is a sure indication that diseased bees are expunged, and that no foreign agression is contested. Moreover, on close observation it will soon be noticed that the shiny bees behave differently to robbers, which as a rule attempt to enter the hive by stealth, and in all sorts of ways and openings beside the common entrance. At times the diseased bees are allowed to crawl about unmolested on the alighting board, and may re-enter the hive, but as a rule they either voluntarily soon come out, or they are pushed out again.

The most remarkable thing I noticed is that frequently a diseased bee is fed by another, just as if induced to do so by sympathy, a feature quite foreign to the general desire of the community to expunge the diseased and useless members. I noticed also that a number of bees encircled a diseased one, and very actively nibbled about at its body and limbs in a caressive manner, agitating at the same time around it. The exact motive of this behaviour I cannot understand, but it appeared almost as if the bees removed something from the body of the diseased one. The process seemed to be agreeable to all engaged in it.

In my opinion this disease is due to *Bacillus gaytoni*, Cheshire, with which the microscopical preparations I have lately made fairly well agree, but a further investigation is necessary to fully establish this fact by more extensive experiments, and by means of cultures, &c., which, however, cannot well be gone into until Dr. Cobb's laboratory is refitted.

Whilst the most of the hairless bees appear considerably reduced in size, I have seen occasionally some specimens with a dilated abdomen, which, because bee paralysis existed in the apiary, may be due to the probability that they were attacked by both diseases. In several instances I noticed both diseases to occur in the same hive, and at one time inclined to the opinion that possibly both were the same under different forms of development. However, from this opinion I have departed since I have more closely observed the progress of both.

The bees nearing death, after having crawled about in an aimless manner for some time, fall over and lie on their side. They die soon, but a twitching of the legs and antennae continues for a little time after they have fallen. When quite dead their tongue protrudes, generally full length, and the abdomen is bent forward; the last feature gives them the appearance of having been stung.

The Diseases possibly Contagious.

Considering the character of them and their development it appears to me that both diseases are due to some bacillus or other micro-organism, and presuming this opinion to be correct, it can hardly be doubted that they are contagious as well as infectious. This seems to me proved by the spreading of the diseases, for, as a rule, when they once make their appearance in an apiary, and are not immediately checked, they run from one colony to another, and often through the whole stand. That it may also be spread by the queen, in my opinion, is very probable, because I know of cases where the disease first appeared in a colony that received an imported queen, and where, prior to this event, nothing of either form of the disease had been noticed. In two of these cases the queens came from apiaries that were affected with one or the other of the diseases.

Some colonies, however, escaped the infection of the diseases, and therefore may be considered as enjoying immunity from them. This is very important, and in all of such cases I noticed that these colonies were populous, and possessed a vigorous queen. Weak colonies, on the contrary, seem generally more readily attacked or suffer more or less from them. Two reasons may account for this: either the stock is composed of naturally weakly bees, that possess little resisting power, or the hive is visited by robbers that, though perhaps not infected themselves with any disease, may bring the contagion from other colonies, and frequently reinfect the numerically—and likely constitutionally as well—weak colony.

Prevention and Cure of Diseases.

A prolific queen, which, as a rule, produces a vigorous progeny, seems to me one of the most important factors in the regeneration of a diseased colony, and the best means of resisting the ravages of diseases, as well as the leading preventive of their recurrence. This theory has already been proved to be correct by practical experiments. A particularly striking instance I will quote. One of Mr. Kitching's colonies was very badly affected at the time I began my experiments at his apiary, but its queen had been superseded some time previous to my arrival. This queen proved to be very prolific, and as soon as her progeny began to populate the hive the treatment I had in the meantime subjected the bees to produced a strikingly beneficial effect, which I must attribute greatly to the assistance rendered by the general vigour that was beginning to pervade the stock from that time. Although this is the most pronounced, it is not the only instance where the beneficial influence of a vigorous queen was observable.

An abundant honey-flow, it has been observed, greatly helps to reduce the mortality, and consequently assists in the elimination of the disease. Besides, to a healthy nourishment I am inclined to ascribe this beneficial effect to the greater activity displayed by the bees during the honey-gathering flights, because it seems to me that a honey-flow has more effect than mere feeding, and, therefore, it cannot well be attributed solely to the more copious supply of food. However, the colonies that are badly supplied with food suffer

undoubtedly more than those that have a sufficiency. Feeding, therefore, should not be neglected whenever the necessary quantity of honey becomes exhausted in a hive, for it stands to reason that a starved colony will succumb to the attack of diseases at once. A thin food that would require shifting from the cells again after first storing seems in my opinion, the most suitable, but whether such should be honey-food or sugar-food, I am not in a position to decide at present. Probably sugar-food would be the more suitable, because the sugar-syrup resembles the natural nectar, and a desirable physical action may be produced by it.*

To eradicate the diseases, I conducted my experiments on the presumption that they are contagious, and therefore originated by some form or forms of micro-organisms. No necessity exists to deal with such experiments that proved ineffective or too tedious. I will, therefore, content myself with those methods that, in my opinion, are necessary to be followed, and which at the same time are the most promising to ensure a speedy cure.

A complete disinfection of the stand of the apiary, as well as of the hives, is a primary condition. If the hives are placed upon the ground a careful chipping out of all the grass and weeds is necessary, which, after they have become dry, should be burned on the ground where they lie. To secure a thorough consumption of the weeds, and a total destruction of the spores that may infest the surface of the ground, it is advisable to strew some readily inflammable material over the area of apiary, such as straw or shavings, to insure a heating of the soil. (It is scarcely necessary to say that the burning of the ground must be done after dark, when the hives may easily be removed without disturbing the bees.) I found it convenient to drag a lighted mob of tow or cotton waste, saturated with kerosene, over the ground, and in this way secured a good ignition of the loose material, and by stirring and leaving a burning flock here and there in places, accomplished the destruction of the roots and stalks where these were lying heaped up, or may be, covered with soil. After disinfecting the ground in this manner it is advisable to rake it and roll it firm before the hives are replaced, because on a firm ground the dying and dead bees may easily be seen and more readily removed.

The safest method of disinfecting the hives is also by heat. Boiling water answers best for this purpose. An immersion for five minutes is necessary, and it must be observed that the water requires to boil during this time, and if much wax and propolis is adhering to the box it is advisable to remove these first. In the case of bee-paralysis, I advise the delay of the disinfection of the ground and hives till after the bees have been purged, for the obvious reason that the excreta most likely contain a large amount of contagious matter, a great deal of which would probably be deposited within the area of the apiary and pollute the ground.

Treating for bee-paralysis I recommend the following method :—Purge the bees; transfer them to a disinfected hive; spray them and the combs with a solution of carbolic acid of half per cent. strength, and repeat this spraying every third or fourth day till the cure is achieved. Occasional feeding with salicylated honey or sugar may also be advisable, which will depend upon circumstances, and must be left to the discretion of the apiarist.

* NOTE.—I am well aware that the moving of honey from cell to cell, for the purpose of drying it, is disputed by many, and doubted by most apiarists; perhaps justly so. Probably it is only done when the bees are not busy with a copious flow, if at all. However, for their consumption they use the fresh honey in preference to the drier or ripe, and, therefore, the thinner a mixture the more likely it will be used first, which serves my argument as well.

To make the bees take the medicated honey in such quantities as is necessary to produce the desired effect, and just about no more than is sufficient, is at all times beset with difficulties. There are various methods of giving food, but in order to allow as many bees of a colony to get at it at the same time in the case of purging them, a frame, covered with finely perforated zinc, that fits the hive, answers the purpose best. The food in this way may be spread over a large surface, and becomes simultaneously available to a great number of bees. Giving the medicated food at night, I closed the hive for sixteen to eighteen hours, and then let the bees go. Finding that oil of cinnamon produced an exiting effect upon the bees, it is advisable to spray them with it in a diluted form—about 20 drops to a ¼ pint of luke-warm water and well shaken—when they are about to be liberated. This will start them to flight, which assists them to void freely. A difficulty of voiding exists when the disease is progressing towards an advanced stage, and this must be overcome by judicious purging and a stimulation to activity. If the difficulty of voiding is overcome, almost prostrate individuals will regain the power of flight. This I observed first with bees I was keeping some time ago under a glass globe for the purpose of making microscopical preparations of them, as well as for the study of the progress of the disease. When the air under the globe became hot through the sun shining upon it, some of the almost dead specimens rallied and became agitated when the heat increased. The consequence was that some of them voided profusely, and then regained the power of flight. Several I allowed to escape through the windows, and saw them fly away apparently as if nothing ailed them. For the "Depilating Disease" the purging may be dispensed with, although it may act probably beneficially in this case as well, but it is not so necessary as in the case of paralysis. The spraying with carbolic every third or fourth day is, however, necessary, and an occasional feeding with salicylated honey is recommended.

During my experiments I found that bees can endure considerably stronger medicines than their small bodies would lead one to suppose, and were it not that the welfare of the larvæ might be impaired, probably very drastic doses might be applied. I have, for instance, very copiously sprayed with a 3 per cent. mixture of formic acid, which did not in the least inconvenience the bees, in fact, in most instances, they greedily drank the globules of it. This 3 per cent. mixture of formic acid undoubtedly greatly improved the condition of the bees, but the ½ per cent. carbolic spray I found the most effective, and, therefore, I recommend it at present for general use.

Besides these applications of medicine, and the general disinfecting of the apiary, there may probably be other very important agencies instrumental in bringing about a cure in either disease, which I think deserve careful consideration. These consist in the renovation of the affected colonies by a more vigorous strain of bees, which can only be brought about by superseding the queen by a young prolific one that has been produced by a healthy colony; more advantageously still by one that has been reared by bees that reasonably may be supposed to enjoy immunity from the attacks of these diseases. This has been already alluded to above, but on account of the importance attaching to it, I deem the reiteration of the subject allowable. Generally before the diseases disappear they seemingly fluctuate in virulence, that is to say the death-rate of bees vanishes by degrees, and then all at once it increases again. This seems to me explainable from the probability that from yet unknown causes during certain periods a more rapid development of the contagion takes place than at others, or that at times the brood is more vigorous and physically superior and contagious-resisting than at others. From this it follows that when the diverse hatchings approach their natural

decay from senility, this is accelerated by the attacks from the disease, and the death-rate becomes more apparent again from the increasing numbers that lie about the front of the hive. Such vexatious increases of the death-rate, however, become less perceptible, or disappear altogether when the new generations springing from a vigorous queen become the numerically predominating inhabitants of the hive. This seems to me an almost complete proof that the greater vigour of the bees is a powerful factor towards the elimination of diseases, and I have no doubt that such a colony, when assisted by rational treatment, will soon become healthy again. Queens reared by healthy and prolific colonies, it appears to me, are therefore of the utmost importance, and their fertilisation by healthy drones coming from a vigorous stock is equally essential. To prevent the fertilisation of queens by diseased or weakened drones, for which a chance exists, although the most vigorous drone always has an advantage, those found in diseased hives ought to be destroyed. Neither the drones nor the queens, although they resist the diseases under consideration to a large extent, I find enjoy complete immunity from them, but if not actually succumbing to the attacks, it is reasonable to conclude that they will produce a weakly progeny, which is a danger in itself.

Regarding my opinion of the importance of superseding the queens in attacked colonies, I am thoroughly in touch with many bee-keepers whom I have conversed with on this subject. For instance, Mr. T. H. Bradley, of Sunnyside Apiary, Appin, a noted and experienced bee-keeper, fully agrees with me, and even goes so far as to almost entirely deny the efficacy of treating the bees with medicines, and thinks the remedy lies solely in the production of physically superior queens. A letter from him, fully discussing this subject, I attach to this report, as no doubt it is pregnant with suggestions of vital importance to the future of the apiculture of New South Wales. I cannot but help agreeing with Mr. Bradley that the excessively practised methods of artificial queen rearing has probably to a great extent been conducive to the physical degeneration, as appears to be the case with some strains of the present bee-races. It is my unqualified opinion that a strong and prolific queen can only be produced when abundance of food is supplied to the larva by young bees, which is the order of nature, and which must not be lost sight of whatever means may be adopted for the purpose of artificially superseding natural queen breeding.

Summarising the methods I recommend for curing the bee-diseases known as Bee-paralysis and Depilating Disease,* they are, in short, as follows :—

Disinfect the stand and hives by heat; in case of Bee-paralysis give a purgative, and keep the bees closed up for fourteen to eighteen hours, and then start them from the hive, and excite them by spraying with diluted oil of cinnamon; spray in either case with ½ per cent. solution of carbolic acid every third or fourth day; supersede the queen of the diseased colonies in both cases as soon as possible by a prolific queen from a healthy strain. As a good honey flow has been observed to help very materially to eradicate diseases, I would recommend feeding in every case where either of the diseases have appeared in a stock in which the supply of food is reduced. It may not act quite as effectively as the gathering of nectar, for which a greater amount of exercise is necessary, and the activity displayed by the bees during this process seems certainly conducive to keeping the bees in good

* This is more generally known as the "hairless" disease, which, however, sounds so irrational that I cannot, on account of this, adopt the name. It is not the disease that is hairless, but the bees become hairless during its progress.

health, but it is the best substitute for it, and will keep the individual inhabitants of the hive strong, and consequently better adapted to resist the aggression of contagion. Moreover, the food thus given can be judiciously medicated with antiseptics, which would be desirable, if not actually necessary.

Regarding the purgatives given by me, I found that podophyllum or senna acted very beneficially without producing any apparent weakening effect; of the two, podophyllum seemed to me preferable. The doses given were: 1 fluid oz.* of tincture of podophyllum to 6 lb. of honey-food; or 4 fluid oz. of tincture of senna to 6 lb. of honey-food, the honey-food to consist of three parts of honey and one part of water, to be well boiled and skimmed. A little extra water has to be added to allow for evaporation during the boiling, the medicine to be added after the food has become cool. Three-quarters of a pound to a pound, according to the strength of the colony, or less if the same is weak, spread over a perforated sheet of zinc, as described before, is about the quantity to be given, but as the number of bees in each hive is often very variable a hard and fast rule cannot be laid down for it. As in many other cases, the administration of the medicine and the general treatment must be left to the judgment of the apiarist, who will know best how to choose a suitable time for it, and who is generally fairly well acquainted with the strength of his colonies.†

I have not tried Epsom salts, but have heard of it being administered with good results. No doubt it will purge readily, and a 1 oz. packet to 10 lb. of food would produce a strong medicine. A somewhat drastic method of purging seems to be necessary to cure Bee-paralysis, but the absence of all stimulating action in Epsom salt induced me to reject it.

McLain's mixture, which has often been applied, can only be regarded as a purgative, because the antiseptic properties of the small quantity of Salicylic acid it contains is entirely destroyed by the neutralising action of the bicarbonate of soda.‡ The bicarbonate of soda, moreover, may act depressingly upon the bee, as it does upon men, and, therefore, this mixture ought to be rejected, because there can be little doubt but that bees suffering from bee-paralysis, whatever its origin may be, require a stimulant rather than a sedative. The salt is evidently the best part of the mixture.

It is well known that salt is required by bees, particularly in spring before any honey flow sets in, and probably acts as a mild purgative upon their constitution. At any rate, it seems to be a tonic, so to say, and therefore it must be recommended to be given at times to the bees, so that they do not require to seek it at offensive places, such as dung-heaps, urinals, or the overflow of closets. It is very desirable that a few small wooden troughs filled with brine, or where the atmosphere is not too dry, a few pieces of rocksalt be kept at every apiary, to enable the bees to get the necessary supply readily and in a clean manner when they feel inclined for it.

To obviate the offensive smell carbolic acid possesses to bees, I mixed the ½ per cent. solution with some oil of thyme. The odour of this, it is well known, is very agreeable to bees, and a dozen to twenty drops of it to a pint of mixture scent it perfectly, and apparently suppress the smell of the

* I found that an ordinary egg-cup holds as near as possible a fluid ounce, and may safely be used in case a graduated vessel is not available.

† Dr. Cobb advised that to 10 lb. of food, 1 oz. podophyllum, or 4 oz. senna be mixed, but I found this quantity not effective enough.

‡ As a cure of foul brood, for which this mixture was originally recommended, its efficacy, therefore, may justly be doubted, as well as its power of destroying other bacilli.

carbolic. Besides the agreeable smell, the oil of thyme possesses antiseptic properties, and, therefore, acts beneficially at the same time. Formic acid I consider very beneficial, and on account of its being the naturally used antiseptic of the bees I experimented with it very hopefully. The result, however, did not come up to my expectation, because the effective action did not appear very readily. Comparing it with the action of carbolic I consider it slow, but it certainly acts very beneficially, and is very agreeable to the bees. It is quite possible, however, that under different conditions the chemicals may prove to act considerably different, and that quite a reverse result may be attained in regard to the application of the different antiseptics. Possibly a stronger than a 3 per cent. mixture of formic acid may be used to advantage, but a weaker one is certainly too slow in its action. The small supply at my disposal prevented me from prolonging my experiments with this acid.*

Salicylic acid sprays I have also found acting too slowly, owing, no doubt, to the fact that the strength of a mixture at ordinary temperature cannot be made to exceed ·2 per cent. That is to say, a cold water solution is saturated with ⅕ per cent. of salicylic acid. If a warm solution is used the excess of the salicylic acid crystalises out as soon as it becomes cold, and in passing through the fine orifice of an atomiser, whilst spraying, chokes it and interrupts the work. I found that if a plain angular tube atomiser that is blown by the mouth is employed, warm surcharged solutions may be used, because the orifice of these sprayers is much larger and does not readily block. On account of this, these atomisers are perhaps the most recommendable for salicylic sprays. The salicylic acid being odourless, is certainly more agreeable to bees than carbolic, and if it can be used strong enough ought to act as effectively. It is, however, to be noted that salicylic acid must not be used in connection with any alkalines, because these destroy its disinfecting properties by neutralising the acidity. The apparent greater solubility of the salicylic acid, if mixed with alkalines, occurs simply through the splitting up of its component parts by the reaction. Worse still is the mixture of it with permanganate of potassium, because the reaction set up by this chemical produces a complete decomposition and oxidation by which the disinfecting properties of both the salicylic acid and the permanganate of potassium are destroyed.

Honey as well as sugar are better solvents of salicylic acid than water, and in consequence of this a strength of ½ per cent. may readily be produced, but not much stronger. To obtain this 1 oz. (by weight) of salicylic crystals to 12 lb. of food, consisting of three parts honey and one part water, or two parts sugar and one part water (and in each case a little water added to allow for evaporation) will produce a mixture slightly above ½ per cent. The salicylic should be added after the food has been skimmed, and then be allowed to boil for a few minutes whilst the mixture is stirred. As in the case of spraying, only salicylic acid should be added to the food, and not borax as well, as recommended in some prescriptions, because the borax is likely to cause a neutralising reaction, and so destroy the efficacy of the salicylic acid.

* Formic acid seems not to be much used in medicine, and, therefore, is rarely obtainable in Sydney. The only 2 lb. I could obtain were, moreover, so terribly diluted, that upon tests made by the chemist of the department, Mr. F. B. Guthrie—to whom I must express my thanks for his valuable assistance on this, as well as other occasions—one sample proved to be 13 per cent., and the other 9 per cent. Such a low percentage can only be due to dilution, because the simply-distilled material produces 55 per cent. of formic acid. This shows how untrustworthy some chemicals are at present found in the Sydney market.

A few more hints for the prevention and the spread of diseases deserve attention. All bees lying about the hives should be removed daily and burnt. Ants I have noticed to carry dead bees to their burrows or under the hives and into crannies. This would undoubtedly tend to encourage reinfection, and therefore ought to be prevented. Dusting the ground of the apiary around and under the hives from time to time with flower of sulphur would be very advisable to keep it pure after the disinfection by fire. It is very questionable whether the wax for foundations is sufficiently heated to destroy baccili, and consequently in taking it from diseased colonies for this purpose may lie a danger of spreading diseases; it is therefore advisable to be careful, and to use only such foundations which are prepared from wax of healthy colonies. Robbing must be carefully suppressed.

From all accounts the honey flow has been very poor this year, and unless it soon alters for the better it is likely that most of the apiarists will find their stocks not so populous at the beginning of winter as they would wish, and after the natural dwindling next spring must expect them to be reduced below the average. If, therefore, diseases were to break out with increased force after next winter, and this should fall together with unfavourable spring weather, enormous losses may occur to bee culture. To prevent these as much as possible, I strongly advise every apiarist that he should take the utmost precaution to provide against excessive losses by a careful "wintering" of his bees. This should include, where the least sign of disease has been making its appearance, the transferring of the frames to a clean disinfected hive and the spraying of combs and bees with a disinfectant, and under any condition a provision for sufficient food and for the general comfort of the bees.

With the present knowledge of the bee diseases I am not able to offer better advice than that which is given in the foregoing, and I feel that many apiarists will object to the somewhat tedious and laborious process of it, and no doubt will wish for a much simpler and less time-robbing method. I am afraid that this will not be very readily found, and therefore preventions cannot be too highly recommended, together with judicious feeding, as soon as it becomes necessary to ensure by natural vigour an increased resisting power against diseases. Vigilance to discover the diseases before they have spread is of paramount importance. Considering the great amount of labour and anxiety that is attached to the treatment of an extensive apiary, I would advise that in a case where a single colony only is attacked in the onset, to destroy this entirely rather than risk the spreading of any disease by contagion. Unfortunately it occurs but rarely that a single colony or a small number only is attacked. In most cases brought under my notice the diseases appeared like an epidemic, and went through a great number of colonies. Great judgment must therefore be exercised whenever the extreme expediency of destroying a colony is resorted to.

Appendix.

Mr. T. H. Bradley's letter, referred to in the above report, is as follows:—

Sunnyside Apiary, Appin, 22 January, 1894.

R. Helms, Esq., Agricultural Department, Sydney,—

Dear Sir,—In reference to our conversation at Mr. Kitching's, Campbelltown, on the afternoon of the 18th instant, relative to the treatment of bee paralysis, permit me to state that while I am fully prepared to admit the importance of your mission to Campbelltown, I am not at all ready to acknowledge that the use of chemicals or drugs will stamp out the disease that has caused such ravages amongst us. To do that we must go to the root of the evil from which the bee-keepers of New South Wales have, I

think, to a great extent only themselves to blame. In my opinion this lies in defective queen-breeding. Apiculture has made enormous strides within the last few years, and largely added to its devotees. With this increase has come the increase of death and disease amongst the bees. After a few weeks' or months' work among bees, the novice arrives at the conclusion that he "knows all about bee-keeping," and "can raise queens as well as the most experienced bee-keeper in the land." To him a queen is a queen—the mother of the colony, but her fitness to fill this important position is altogether a matter of minor consideration. The second year of his novitiate usually finds him advertising himself as a queen-breeder—a specialist in fact. On inquiring into his system of breeding, it will be found that "it is the easiest thing in life; simply take the queen from a strong colony, and you have in a few days as many young queens as you can use." In a recent issue of a well-known bee paper this system was openly advocated by one writer, and was not only allowed to pass uncriticised by the editor, but the author was subsequently alluded to as an experienced bee-keeper.

Natural swarming, or, in other words, "the survival of the fittest," the system instituted by the Great Creator, and pronounced by him to be "good," is getting to be old-fashioned, and death and disease are following in the footsteps of the new fashion. Nature's laws are persistently violated, and nature enters her protest in the form of disease and death.

With the advent of foreign races of bees came what is termed artificial queen-rearing. Art is always supposed to be able to improve nature, but in the matter of queen-rearing it is attempted to supercede her. As Doolittle, the great queen-breeder of America, so clearly points out, artificial queen-breeding can only be successful when conducted in accordance with nature's laws. It stands to reason, otherwise, that we shall have our bees so delicate in constitution that they will not be able to stand the attacks of bacteria. That the hardy race of bush bees are able to resist the bacilli of foul brood and paralysis I have very good testimony. For years past I have been making inquiries among old bushmen and bee-keepers, and from their description of diseased combs found in trees and boxes, I have no doubt but that foul brood existed or was present in Appin forest more than twenty years ago. It was once found in a tree on the bank of a creek, but, although several other bee trees were felled in close vicinity to it that season, not a trace of the disease was found in any other tree. A bee-keeper with about 200 box hives noticed foul brood in five or six of his colonies. These swarms died out, but the disease did not spread. Let foul brood appear in five or six colonies in a modern apiary of about 200 hives, and allow it to go unchecked for a time, what would be the result?

If you will institute inquiries you will, I think, find that the box hive bee-keeper does not suffer so much from bee paralysis as his more scientific brother. For example, a neighbour of mine, a box bee-keeper, who has about the same number of swarms as Mr. Kitching has, told me he had lost one swarm from a disease, but did not regret them much, as "that swarm was never any good for work." On inquiring carefully, I found the disease was undoubtedly bee paralysis. None of his other colonies were affected. Here we have two apiaries in the same district, within 10 miles of each other, the one conducted on nature's plan, the other on scientific principles. The one suffers to the extent of about 5 per cent; the other, about 75 per cent. In the one, the disease dies out with the swarm, although every facility was afforded for its propagation by robber bees. In the other, the aid of the chemist and entomologist was sought to prevent utter annihilation of the apiary.

I have carefully studied this subject, and have given it much thought, but did not intend giving my ideas publicity until I had thoroughly worked them out in my own apiary, but as you have asked my opinion on the origin and progress of bee paralysis, I give it to you. Summed up in a few words, I think it all lies in defective queen-breeding.

I am, &c.,

T. H. BRADLEY.

On the Choice and Use of Artificial Manure.

By F. B. GUTHRIE,
Departmental Chemist.

Crop Requirements.

In connection with the rational application of artificial manures, we have, as we have seen from the last paper, the following points to consider:—

1. What are the chemical requirements of the different crops?
2. In how far do our soils supply these requirements?
3. In what direction are they to be assisted by manure?

I do not propose to touch upon the question of tillage or of general farming operations, except in so far as they may produce chemical changes in the soil constituents. The action of the different manures will be regarded entirely from a chemical point of view as plant food.

In the first place, with regard to the requirements of the different cultivated crops. A very superficial observation is enough to show us that the food required by different plants must vary considerably. Plants vary enormously in character. Between the fruit of the different species there is an almost infinite variety. The nourishment that produces the sparse leafage of the cereals can obviously not be the same that is required for the leaf-masses of such crops as lucerne or cabbage. The differences are not in all cases so obvious, but we may safely say that every plant requires one or more special sort of food, and exercises a power of selection in regard to such food. Some crops cannot make use of the soil-ingredients to the same extent that others do. Some crops also occupy the ground for a longer period than others; those that come rapidly to maturity will require a larger store of food which is immediately available. Again, their requirements vary in many cases at different stages of their growth. What these special requirements are we will now proceed to examine more in detail for each class of crop.

Cereals.

Wheat.—The quantities of the different fertilizing ingredients removed from the soil are as follows:—These, and similar figures with regard to other crops, are taken from Warington's Chemistry, and refer to English conditions. If the figures here given as the average weight of the crop appear too large to our farmers, all I can say is that there is no reason why we should not produce crops of the same average weight. These crops were obtained by the proper and scientific application of manures on the lines I am advocating, and there is not the slightest reason to doubt that we can obtain the same results by the application of the same principles. A wheat-crop of 30 bushels grain to the acre weighs about 5,000 lb., or something over 2 tons of grain and straw, and removes from the soil during the period of its growth 48 lb. nitrogen, 21 lb. phosphoric acid, and 29 lb. potash. The

wheat crop depends practically entirely upon the soil for its nitrogen, so that for the whole of the above quantities of food the wheat is dependent upon the supplies existing in the soil. Now, 48 lb. nitrogen is equivalent roughly to about ·003 per cent., as indicated by analysis in a soil of average weight 6 inches deep. This quantity is very much less than the average percentage of nitrogen in our soils, which is quite ·1 per cent. That means that if the nitrogen in the soil were immediately available the poorest soil would contain abundance of it for a succession of several crops. But the wheat-crop does not appear to be capable of utilizing the soil-nitrogen to its full extent, consequently the application of soluble nitrogenous manures are particularly beneficial to it and the other cereal crops. The same remarks applies to phosphoric acid and potash.

Twenty-one pounds phosphoric acid represents about ·001 per cent. phosphoric acid in a soil of average weight and depth. This quantity is present ten times over, even in poor soils, as is ·002 per cent. potash, the quantity represented by 29 lb. potash, required by the plant. If, then, it were possible to convert the plant-food in the soil into an available form at the times that the plant can make use of them the necessity for manuring of any sort would be done away with.

One reason why introgenous manures are particularly beneficial lies in the fact that the period of the active growth of the wheat-plant ceases before the period when nitrification is most active. During the summer and early autumn certain organisms are active within the soil, by the action of which the soil-nitrogen is converted into nitrates.

Nitrates are exceedingly soluble salts, and particularly adapted for supplying the wheat-crop with nitrogen, but their formation commences after the crop has ceased its active growth and they are washed away from the surface soil before the succeeding crop can make use of them.

Wheat thrives best in soils of moderate stiffness, and does better in a moist soil than most cereals. In a moist climate it is said to do better on a light than on a heavy soil.

It is a usual practice to grow a root crop, especially turnips, before wheat. During the growth of the turnip crop, nitrogen is stored up in the soil, and the roots tap more especially the lower strata of the soil. Lime is an essential ingredient in wheat lands, but the manures which are especially beneficial are nitrogenous ones.

It is still an undecided question whether wheat absorbs its nitrogen in the form of ammonium salts or nitrates, but whilst the consensus of opinion points to the probability that it is in the form of ammonia that it actually enters the plant, yet it is generally admitted that nitrate of soda is the most effective form of manure. Sulphate of ammonia is, however, considerably cheaper with us, and on that account will be our most effective fertiliser.

The cheapest method of applying nitrogen to the soil is by means of what is known as green manuring. Leguminous crops, such as cow-pea or clover, have the power of utilising the nitrogen present in the air in a manner we shall go into more fully later on. When such a crop is allowed to grow until its period of active growth ceases—that is, until it flowers, and then ploughed in, not only are all the fertilising ingredients which it has abstracted from the soil returned to it, but the land is further enriched by an additional supply of nitrogen. The nitrogen in this form is not in such a soluble condition as the nitrogen in sulphate of ammonia, but the method is a cheap and effective one, and in cases where it can be conveniently applied, will be found of great value in improving the land, for, in addition to the direct supply of nitrogen, the decay of the crop within the soil

produces a store of humus, and exercises a solvent action upon the other soil-ingredients, hastening the natural decomposition of the soil, and benefiting it both chemically and mechanically.

The crops best suited for the purpose are such leguminous crops as mature quickly, and do not occupy the land for any length of time, and are otherwise of no great value as crops. I simply wish to draw attention briefly to the subject here, postponing a fuller discussion of the matter to a separate note.

Wheat occupies the ground for a very much longer period than other cereals, such as oats and barley, and removes rather a larger proportion of soil-constituents. It is, therefore, a somewhat exhausting crop.

The best manures for wheat in the soil of average quality is an autumn manuring of fine bone-dust and dried blood, about 3 cwt. per acre, followed by a top-dressing in the spring of a mixture of 2 cwt. superphosphate, and $1\frac{1}{2}$ cwt. sulphate of ammonia per acre; or instead about 3 cwt. per acre of a good phosphatic guano. This spring dressing it is best and most economical to apply in two portions, the first when the young plants begin to shoot, and the remainder at a somewhat later stage. If the above quantities are all applied at once a large proportion would not be immediately utilised, and would be washed away and lost. By applying it in two separate portions the fullest benefit is obtained.

Nitrogenous manure should not be applied at a late stage of the plant's growth.

On land rich in lime an autumn treatment of 2 cwt. superphosphate per acre is sometimes recommended instead of the bone-dust.

Do not use the nitrogenous manures in quantities much larger than those recommended above, as too much nitrogen is injurious, causing a tendency in the plants to become too green and to "lay," but mineral manures alone are not of much benefit unless a sufficiency of nitrogenous matter be added.

In no case is it intended that the manuring here suggested is to supplant farm-yard manuring. Where such is at hand or can be readily and cheaply obtained, let it be the staple manure. It is of permanent benefit to the soil. For some crops, however, it does not contain the particular ingredient which they require in sufficient quantity, whilst it contains other ingredients which they do not require, and which are consequently wasted. The chemical manures here in question are intended to supplement it where it is used.

Of the other cereals

Maize prefers light porous sandy loams, and does not do so well upon stiff clay soils. It is a gross feeder, and needs heavy manuring.

Rye accommodates itself to lighter and drier soils; in fact, the poorest soil is usually considered good enough for rye. The presence of lime is not of so much importance as with wheat.

Barley requires a light fertile soil, warm and friable, and grows most strongly, and produces the largest crops on land well tilled and heavily manured. If, however, the grain is grown for malting purposes, the application of nitrogenous manures is to be avoided, as the grain produced by such treatment contains a large proportion of nitrogenous matter, which injures the keeping qualities of the beer, the starch in the grain being likewise diminished.

Oats thrive best in a damp climate and moist soil, with a moderate summer temperature. They contain considerably more potash in the straw than the other cereals.

The manuring recommended in the case of wheat apply more or less to all the cereals. They are all especially benefited by the application of nitrogenous manures.

The autumn manuring may consist of farm-yard manure, dried blood and bone-dust or superphosphate, with a spring top-dressing of superphosphate and sulphate of ammonia, to be applied in two portions, as already indicated.

All soluble and concentrated chemical manures should first be mixed with about three times their weight of dry loam before they are applied to the land. This ensures their even distribution, and it is otherwise extremely difficult to avoid adding it in wasteful quantities in some places, and in too small quantities in others. It also prevents their accumulation about the seeds or roots, which they would be liable to damage. It further prevents their being blown away by the wind in dry windy weather, or their being too rapidly washed away in rain. In the case of a very light open soil this is especially necessary, and caution should be exercised in the use of soluble manure in such cases, as they are liable to be washed away before they have benefited the plant. As a rule slow-acting manures are the most applicable for autumn dressing; the soluble quick-acting manures being most beneficial at an early stage of the plants growth.

Grass.

A crop of 1½ tons meadow hay per acre contains on the average 49 lb. nitrogen, 51 lb. potash, and 12½ lb. phosphoric acid.

The question of the appropriate manuring of grass-lands is complicated by the question as to whether it is intended for permanent pasture or to be cut for hay, and whether grass or clover is to predominate. It may be stated generally that the proportion of clover is increased by the application of manures containing potash and phosphoric acid, and diminished by the application of nitrogenous manures.

Too heavy manuring of any kind, especially nitrogenous, tends to the growth of coarse grass. Manures containing lime such as plaster, also promote the growth of clovers.

For grass the best results were obtained by Lawes and Gilbert, by the application of mineral manures (superphosphate and kainit) together with sulphate of ammonia. Heavy grass-crops were obtained to the almost total exclusion of clover. To promote the growth of clovers, omit the ammonium salts from the above mixture, and manure with mineral fertilisers alone.

Stable-manure and compost is an excellent manure for grass-lands, especially when mixed with sulphate of ammonia.

Root-crops

Exhibit a greater variety in their food requirements than the cereals, and differ more amongst themselves. In all cases the crop contains a larger proportion of nitrogen than the cereals, but they appear to possess to a far greater degree than these the power of assimilating the nitrogen as it exists in the soil, consequently the application of nitrogenous manure alone is, as a rule, without much benefit. The exception being the mangel crop, for which purely nitrogenous manures are distinctly beneficial. They all produce far more bulky crops than the cereals, and remove proportionately larger quantities of the soil ingredients. They, therefore, require liberal manuring, and are especially benefited by the application of potash.

Potatoes.—A crop of 6 tons potatoes weighs about 18,000 lb. of tubers and haulm, and removes from the soil 67 lb. nitrogen, 80 lb. potash, and 24 lb. phosphoric acid. As in the case of the cereals these quantities are abundantly present in the poorest land, and it is only a question of the power of the crop to assimilate them.

Potatoes do well in most soils, best on loose mellow soils. Virgin soil appears particularly well adapted to their growth. This may be partly due to the manuring of potash the soil receives from the clearing and burning away of the timber. The sub-soil should be porous, the tubers are liable to rot in land with stiff sub-soil, or in very retentive soils. The soils should not be too stiff, otherwise there is not room for the roots to develop.

They are surface feeders, and, as might be expected from the preponderance of potash in their composition, the application of potash manures is especially beneficial. Kainit is a very valuable manure for the potato crop, and plays much the same part in regard to it that nitrogenous manures do in the case of cereals.

The addition of kainit alone is, however, not usually of much benefit, and it is usually applied together with superphosphate. Before sowing, the best treatment for average land is the following:—About 3 cwt. superphosphate, mixed with 2 cwt. kainit, and 1 cwt. sulphate of ammonia per acre.

The farmer will find it will repay him to buy these ingredients separately, and mix them himself, as by so doing he not only saves the cost of mixing but he can vary the proportions of the different ingredients to suit the requirements of his soil. In fact, in all cases where it is feasible, the farmer will generally find it more satisfactory to mix his own manures, particularly where the quantities are small enough to be mixed by hand.

Turnips.—A crop of 17 tons roots per acre contains 49,000 lb. of root and leaf, and removes from the soil 112 lb. nitrogen, 149 lb. potash, and 33 lb. phosphoric acid in round numbers.

They thrive best on light loams, loose and open. The land for the turnip-crop requires more thorough tillage and previous preparation than for any other crop, but this question is outside the scope of the present articles.

They are a crop that require heavy manuring, and a liberal dressing of farm-yard manure is essential to their successful cultivation. Though the quantity of potash is larger than in the potato crop, potash manures have not the same marked benefit. Their weak point appears to be their inability to make use of the phosphoric acid in the state in which it exists in the soil, hence the manures from which they derive especial benefit are those containing phosphoric acid, such as superphosphate or bone-dust. Three to 4 cwt. superphosphate per acre is the average proportion.

Mangels.—A mangel crop of 22 tons weighs 67,000 lb. roots and leaves, and removes 147 lb. nitrogen, 300 lb. potash, and 53 lb. phosphoric acid. Mangels are deep feeders, and require a deep and well-tilled soil. They form an exception to most root crops in that they are capable of utilising the phosphoric acid and potash present in the soil, and the manures that specially benefit them are those containing nitrogen. On a rich land, or one already well manured with farm-yard manure, the application of a soluble nitrogenous manure alone is of marked benefit, though, as a rule, it is added together with superphosphates.

Beet-root—Is also a crop that requires nitrogenous manures in conjunction with bone-dust or superphosphate.

Chemical Notes.

By F. B. GUTHRIE,
Departmental Chemist.

Manufacture of Superphosphate.

The following reply to a correspondent, asking for information as to the best method of preparing superphosphate on a small scale, may prove of service to those who would like to manufacture a small quantity for themselves.

It is advisable in the first instance to burn the bones and convert them into what is known as bone-ash, as fresh bones or bone-meal produce a slimy mass on treatment with acid which is exceedingly difficult to dry.

To prepare the superphosphate from bone-ash it is necessary to have a receptacle for mixing the ingredients which is not attacked by sulphuric acid. A wooden trough lined with lead (a sheet of lead hammered to fit the trough) is about the best; but the wooden trough, pitched inside, will answer the purpose, or a hole in the ground lined with cement. In this receptacle, the ingredients are mixed in the following proportions:—For every 40 lb. of bone-ash add 1 gallon of water and 15 lb. strong sulphuric acid (commercial oil of vitriol). Pour the whole of the water into the tank, then add *gradually*, stirring constantly with a wooden pole, the sulphuric acid. The acid combines very violently with the water, and unless it be added as directed above an explosion may result. Now add gradually, a little at a time, the bone-ash, stirring constantly with a stout pole or hoe. The above proportions should yield a mass possessing the consistence of a stiff dough. If it is not stiff enough some more bone-ash may be added. Leave it to itself for a few hours, when it will dry to a friable mass, easily broken, and in a fine state of division. Protect from rain whilst drying. The manure is now ready for use. Although burning the bones destroys the organic matter and diminishes the proportion of nitrogen, this loss is more than compensated for by the ease with which the product can be dried and handled. If fresh bones or bone-meal be used the fat which they contain prevents the complete action of the acid, and the resulting product is so slimy as to be unmanageable in many cases. If it is preferred to use fresh bones or meal, the following proportions are said to be the best:—

Dilute every ½ gallon of acid with 1 gallon of water, as directed above—that is, add the acid to the water, stirring all the time. Never on any account add water to the acid. Pour this diluted acid upon 20 lb. of the bone-meal in the trough, taking care to pour slowly, stirring all the while. The sticky mass must now be mixed with loam, wood-ashes, peat, or gypsum, in order to dry it. Instead of burning the bones the oil may be removed by steaming them, but this is rather a troublesome process. Simple boiling with water is better than nothing, though in no case is the product so satisfactory as that prepared from burnt bones.

Instead of using acid, bones may be rendered soluble by allowing them to ferment. The following is a good plan:—

Dig a trench and fill it with alternate layers of wood-ashes and bones, beginning and ending with wood-ashes. Moisten each layer of ashes when laid, and keep the whole moist by watering from time to time. In a few months the heap may be turned over.

Bones are also dissolved by placing them in a pit and drenching with a hot solution of lye, 1 lb. of potash lye to every 4 lb. of bones. Cover with earth, and stir occasionally for two or three weeks, when the mixture may be turned out to dry.

It will be seen that treatment with acid is the most rapid, and the product just as satisfactory, but caution is required in mixing the ingredients.

Analysis of Bone-dust.

The following is the composition of a bone-dust mixed with blood, forwarded for analysis by Messrs. Jules Rénard:—

Moisture...	= 8·21	per cent.	
Organic and volatile matter	= 58·82	,,	containing—nitrogen = 6·66; ammonia = 8·09.
Sand and insoluble matter	= 2·39	,,	
Tri-calcic phosphate ...	= 26·31	,,	(= 12·05 $P_2 O_5$).
Other lime salts, calculated as carbonate ...	= 4·09	,,	

Mechanical condition.

Fine	=	26 per cent.
Medium	=	63 ,,
Coarse	=	11 ,,

This is a good bone-dust, containing blood and meat, the amount of nitrogen being particularly high. The product is in fair mechanical condition, and its manurial value, as calculated from the above analysis, is £5 15s. 9d. per ton.

Reports of Deaths of Sheep in various Districts.

THE following report on the above subject has been submitted by Mr. R. D. Jones, Acting Chief Inspector of Stock:—

Recently reports have reached this office from several districts of considerable numbers of deaths among sheep, and as some of these have occurred rather suddenly, the cause has been attributed to anthrax.

From the description of the various organs after *post-mortem* examination, I am convinced that the greater portion of the losses are not occasioned by anthrax, but rather by anæmia, consequent upon dropsical affection induced by liver-rot, or fluke, in an advanced stage.

I am further convinced that much of these losses from the disease last referred to may be averted by change in the system of management.

Sheep have been placed upon country for years past which, in the first instance, in my opinion, was never naturally intended for them; and by continuously stocking, and in some cases overstocking, this country, many of the original and virgin herbages and grasses have been eaten out. The surface features of the land have also changed by reason of storages of water in swamps and breaking out of springs; and in many instances little or no attention has been paid to drainage of land which is naturally devoid of all saline properties, and by that reason most favourable to propagation by natural agencies of fluke, and owners have not, as a preventive, used salt plentifully in addition to sulphate of iron, but have in many instances had recourse to these substances when the disease has become firmly established.

These alteratives are not cures—merely preventives—and tending to assist any natural defect in the country by supplying the requisites to maintain health.

Further, sheep of the same age are, to a large extent, kept in the same paddocks for many months without any change. This, in itself, is a mode calculated to induce disease; and it is only reasonable to suppose that a change of diet is most necessary and essential to good health in sheep, as in all other animals.

Sheep of different ages require different feed, as an animal of a year old, or less, cannot digest, thrive, and maintain good health upon the same diet as an animal of mature age; neither can those that have passed the prime of life assimilate the same class of food as those of a more youthful age.

I am convinced that were sheep changed with tolerable frequency into other paddocks (although it is some labour and trouble to do so) the results would in every way compensate, and the death-rates, as occurring lately, would be, I am sure, considerably reduced; and I would desire, with all respect, to place these suggestions before the owners of sheep in this Colony, in the hope that they may be induced to practically test the mode herein described, and the results will, as before stated, I feel sure, be in every way satisfactory.

Poultry Notes.

By S. GRAY,
Sub-Editor.

By the time this appears the cold weather will be close upon us over a large portion of the Colony, and where it has not already been done prompt steps should be taken to keep fowls warm and comfortable during the winter months. I wish to impress most strongly upon my readers that no matter what kind of fowls they keep, or what their reputation may be as winter layers, warm and dry houses are absolutely necessary. A very great difference of opinion appears to exist on the subject of ventilation. Ventilation is not draught. One of the first steps to be taken is to carefully fill in all cracks in sides and roofs of roosting-houses, so that draughts may be impossible, and then providing some regular means of ventilating the house, which may be done by means of the exit for the birds at the bottom of the door and a few auger-holes along the top. This having been attended to, the floor should be thoroughly cleaned out and sanded, and the interior, including roof, sides, perches, and nest-boxes, thoroughly washed with hot limewash. It will also be found of advantage to provide the birds with a covered run where they can scratch in wet weather. The feeding at this season of the year is also a matter of importance. The morning meal, which should be given as early as possible, should consist of a warm mash having a foundation of pollard mixed with any house-scraps which may be available, and occasionally in the evening good sound maize may be fed with advantage. In very cold weather it is a good plan to litter the covered run with straw, into which a handful or so of wheat or oats may be thrown. The amount of scratching which this will cause will soon put the blood in circulation, and greatly assist in keeping the fowls in health, and consequently in profit. For green food, hang up a head of cabbage, so that the birds can peck at it.

At this time it becomes necessary to decide how many and what birds can be profitably, and with comfort to themselves, retained during the winter. It must not be forgotten that practically all the food required during this season must be supplied, and therefore to retain useless birds would be extravagance. Valuable stock-birds will, of course, be retained for next season's breeding, and, in addition to these, sufficient pullets for laying, and cockerels for the table, should be selected from the flock. The balance, which will under proper conditions consist of young birds, should be sent to market as soon as they are in marketable condition.

It may be as well at this juncture to repeat the advice I have previously given regarding the marketing of poultry. There is no doubt that a little extra care will, as in all other commodities, secure an extra price. If the stock which it is decided to dispose of numbers many head, about two dozen should be penned off to commence with. These should, as far as possible, be of one colour and age. They should be well supplied with food, in order

to bring them to a nice plump condition, and after about a week of careful treatment be placed in a clean coop and dispatched to the nearest or best market. When they are in the coop the reason for selecting them of similar colours will be readily apparent in their improved appearance, and this, combined with equality of age and condition, will not only command an increased price for the particular coop, but will, in all probability, ensure a customer for next market-day. It is in this connection that the recommendation I have often given to keep one, or, at most, two breeds of fowls will be readily appreciated.

With regard to eggs, there are one or two matters which from the existing state of the egg-market would appear to require amendment. There is on many farms a great want of system in collecting eggs. The hens are allowed to get into the habit of laying in all sorts of places rather than in the nest-boxes, and consequently an egg is often collected from some nest which is discovered by accident. The result of this is that there is no certainty when it was laid, and, while the eggs are sent in all good faith to market, the housekeeper finds a rotten egg included in the dozen which she had paid for as fresh. This laying away is often caused by the nest-boxes provided being allowed to become neglected and dirty. A hen will always prefer a secluded and clean nest, and unless she finds this in the fowl-house she will look elsewhere. This is a matter which is well worth attention, and I cannot too strongly impress it upon poultry-keepers. More customers are lost by this than is generally appreciated, and the remedy is simple. Confidence of customers is as necessary to poultry and egg dealers as to Bankers.

Practical Vegetable-Growing.

Directions for the Month of May.

If the directions given during the last few months have been carefully followed, there should now be available an abundance of many kinds of good vegetables for use.

Those readers of the *Gazette* who have some spare ground, but who do not grow their own vegetables, are strongly urged to make a start, if only with a few kinds; for, with a good supply of manure, which should be available on every farm, it is wonderful how great a supply can be obtained from a very small portion of ground. It may be expected that a beginner will make some mistakes, but this should not cause him to lose heart and give up the work, for success can only be attained by patience, perseverance, and practice.

The vegetable most frequently grown in the Colony is the cabbage, and perhaps it is as good a one as any to begin with. It is wholesome and nourishing when well grown, but great size should not be aimed at, those of a moderate size being the best and most palatable. There are many varieties of cabbage, some being best suited for certain districts, and others for different localities; therefore it would be advisable to try several kinds until it be ascertained which particular kind is most suitable. Take, for instance, the Savoy, which comes to the greatest perfection in cool climates, and also the Brussels sprouts, which, when well grown, is one of the nicest of vegetables, but, which, strange to say, is but rarely to be seen in gardens. Of the Savoy and Brussels sprouts there are several kinds, some better than others. Amongst the cabbages—for they belong to the same family—are the borecole or kale of varieties, the broccoli, the cauliflower, and also the turnip-rooted cabbage or Khol Rabi, and there are many kinds of each of these. The general cultivation needed for all these vegetables is much the same. The seed should be sown in small beds, in drills, and when the seedlings come up they must be transplanted to some ground that has been dug up well and heavily dressed with rich farmyard manure. The young seedlings should always be planted out in rows equidistant from one another, and the ground between the rows should be frequently hoed, and kept free from weeds. If it be possible, a thick mulch of farmyard manure should be spread around the plants and between the rows so as to cover all the ground. If this can be done, it will not be necessary to hoe so frequently, unless weeds are prevalent. When moving the young plants from the seed-beds, a good deal of care should be taken to avoid breaking off their roots. A little practice will enable anyone to do this easily and effectively. All garden operations should be done with care and neatness, without hurry. It is far better to produce one good plant than a dozen bad ones. If the plants are moved carefully they will grow right away without flagging or dropping the greater

number of their leaves, which they generally do if pulled out of the seed-beds and planted with a dibber or pointed stick. Cabbage seedlings generally come up very thick in the little rows, unless the seed is sown very thinly, but it is almost useless to advise a beginner, or almost anyone, to sow his seed thin; he will sow thick, and is afterwards afraid to waste his plants by thinning them out. However, the best thing to do will be to "prick out" the plants—indeed, it is an excellent practice to adopt in every case. Pricking out means, to plant out the seedlings on a well-prepared piece of ground a few inches apart, so as to give them sufficient space to grow freely, and when they are good strong plants they can be shifted to the places where they are to finally develop. This pricking out may be adopted for other plants besides the cabbage family. Lettuces, celery, leeks, tomatoes, may all be improved by this little extra trouble. Everyone who grows vegetables should bear in mind that it is a great mistake and waste to sow much seed at a time. It may be stated that cauliflower seed does not, as a rule, come up nearly so well as cabbage. Why this should be the case it is difficult to say.

When growing other kinds of vegetables than the cabbage it will also be advisable to try several varieties of each. Amongst onions there is considerable diversity. Some are very large, others small; some are most highly flavoured, others mild. Then allied to the onions to some extent are the leeks, shallots, chives, and garlic, all useful for various purposes.

The carrots vary considerably; some long, others medium-sized, and again some are almost like turnips in shape. And so on with all vegetables. Great efforts are made by those in the seed-growing business to produce new and improved varieties, but not infrequently the size is improved but quality sacrificed.

Asparagus.—If some ground has not already been prepared for planting it should be taken in hand soon, so as to be quite ready for planting during the winter or early spring before the shoots or buds start into growth.

Artichoke (Globe).—Plants or suckers may be planted at any time during the month. The soil should be a rich sandy loam, moist but well drained, for this vegetable to come to perfection. Half-a-dozen plants will probably be enough to grow. They may be planted in a row about 3 to 4 feet apart. The artichokes will succeed pretty well on most soils, if not too dry, provided the ground be well manured.

Beans, Broad.—Seed may be sown largely during the month, say a short row or two, at intervals of a week.

Beans, Kidney or French.—Should only be sown in the warmest parts of the Colony, where frosts are not likely to occur. Old plants should be cleared out of the garden immediately they cease to be productive. One great secret of success in producing a large quantity and variety of vegetables on a small space of ground is to prevent old useless vegetables from occupying valuable land which should be manured, dug up, and put under crop as soon as possible. This does not seem to be generally understood.

Brussels Sprouts.—Sow a little seed during this month in a seed-bed, or even in a box, in order to have some plants coming on for successional planting. If strong plants can be obtained they may be planted out.

Cabbage.—Sow seed of several varieties, as recommended before, once or twice during the month. If strong seedlings are available plant them out.

Cauliflower.—Sow a little seed occasionally, and plant out strong seedlings, a few at a time.

Carrot.—This is a most useful and wholesome vegetable to have on hand. Sow a little seed occasionally in drills about a foot to 18 inches apart. Sprinkle the seed thinly along the shallow drills, and cover by hand with fine soil. The seeds are covered with little hooks, and this causes them to stick together. Before sowing rub the seeds so as to separate them. Keep young plants free from weeds. The soil for carrots had better not be freshly manured or else they are liable to fork. If the ground is very poor, and it is necessary to apply manure, use that which is thoroughly rotted, and mix it well with the soil.

Celery.—Sow a very little seed, and plant some good strong seedlings in shallow trenches. Apply a heavy dressing of manure before planting.

Endive.—This is a plant rather like lettuce in appearance, and it is used as a salad. Sow a little seed, in the same manner as you would lettuce, and afterwards transplant the seedlings when they are large and strong enough. The soil should be made rich, for the plants should be grown quickly so as to have them tender.

Leek.—Sow some seed, and plant out the seedlings when they are 8 inches or so in height. The ground must be made very rich to grow the leek to perfection, for it is a greedy feeder.

Lettuce.—This a good time to sow seed, and also to plant out strong seedlings from previous sowings. Move the plants without breaking any roots if possible. The great object to attain is to grow the plants without a check, and this can be done if they are carefully taken out of the ground, and carefully planted. Make the soil rich with well rotted manure.

Onion.—A most useful and wholesome vegetable which should be grown largely. The ground should be made rich and worked fine on the surface, and particular care should be taken to have the beds well drained. Sow in rows, and barely cover the seed with fine soil. Keep the beds quite free from weeds, and to facilitate weeding, the beds should be made narrow. Soot mixed with salt half and half, makes a useful top-dressing sprinkled amongst onions when they come up.

Parsley.—Sow some seed of this useful plant.

Parsnip.—Sow a little seed in drills. This is a deep rooting plant, and therefore the soil should be deeply worked.

Peas.—Keep on sowing a row or two from time to time in order to keep up a continual supply if possible for it is hard to find a better vegetable than the pea. Sow in rows about 3 feet to 4 feet apart. The drills shall be about 3 inches deep, and the peas about 3 inches apart in the drills.

Radish.—Sow a little seed frequently in order to keep up a supply.

Sea Kale.—Sow a very little seed.

Spinach.—Sow a little seed.

Shallots.—Plant out some bulbs or cloves in rows about 12 to 15 inches apart. Do not bury the clove deep but just press it firmly into the soil.

Herbs.—Sow seed and lift, divide and replant old plants.

Orchard Notes for May

May, coming between the season of the summer or deciduous fruits and that of the main crop of the most of the citrous fruits, is usually a somewhat slack time for orchardists as far as the gathering and marketing of their produce is concerned. Still, it should be by no means an idle time, as in an orchard there is always work to do if it is to be kept in the proper condition necessary to produce the best results, Any extra work that is required can be done now, such as draining, where necessary, and the scouring out of all existing surface or open drains, as well as seeing that the outlets of all such drains are clear, so that there is a get-away for the water, and that the drains themselves are in good working order, as a choked drain is often worse than no drain at all. All dead or valueless trees that it is desirable to remove should be taken out now if not done previously; and the hole from which they are taken should be allowed to remain exposed to the air till the new tree is planted that is to replace the one taken out. Any fences or gates that require mending should be mended, and any other odd jobs there may be should be attended to when you have the chance, as in a busy time they are apt to be overlooked, and though often insignificant in themselves, the neglect to attend to them often causes considerable inconvenience or loss. In fruit-growing there is only one secret of success, and that is thoroughness. The better the orchard is kept, the better fruit it will produce and the better it will pay; and bear in mind that if an orchard will not pay when properly managed, then it will not pay in an untidy or neglected state.

If it is desirable to lime the orchard, and if the soil is of a sticky, retentive nature, liming, as an adjunct to draining, will be found to be of very great value—not so much from the manurial value of the lime itself, as from the mechanical effect it produces, by bursting up the soil, and rendering it more friable, and therefore more easily worked. Lime has also a good chemical effect on the soil, besides its mechanical one; as, if the soil is at all sour, it sweetens it by directly neutralising the free acids present in the soil, and to which its sourness is due; also, by its action in bursting up the clayey matter of the soil, it also renders a considerable portion of the potash contained in the clay available for plant food, and potash may be said to be the dominant ingredient in the ash of nearly all of our fruits, as it is more largely required by the fruits than any other plant-food which it is necessary to supply to the soil in the form of manure when it is not present in the soil in sufficient quantity. If lime is required for its mechanical and chemical effects, rather than for its purely manurial value, it should always be applied in the caustic form—that is, unslacked, or only sufficiently slacked to permit of its being evenly distributed, when it should be lightly ploughed in at a rate of 2, 3, or even 4 tons per acre, according to the nature of the soil. Never apply any other manure at the same time as the lime, or the lime will set free all the ammonia it contains, so that it will pass off in the form of gas, and be lost.

Insoluble or only slowly soluble manures, such as bone-dust and boiling-down refuse, can be applied during the month to either citrus or deciduous fruit-trees where the soil is not of a too sandy or porous nature, as they will become slowly available for plant-food during the winter months, and will be ready for the tree's use when they start their spring growth.

Pruning can be commenced during the month with plums and peaches if all the leaves have fallen, as the sooner it is done after the leaves are off the tree now the better, as the energies of the tree are then devoted to maturing the buds that are left instead of all that are on the tree, a large number of which will in any case have to be pruned away afterwards. Where new orchards are to be planted out the land should be got ready when not done previously, but with new land it is always preferable to have the land broken up some months previous to planting so that it may become thoroughly sweetened.

The main crop of lemons will be getting ready for gathering during the month, and as soon as they ready for gathering, that is, just as they are beginning to turn colour, they should be cut from the trees and cured instead of being allowed to remain on the trees to the detriment of the quality of the fruit and to the injury of the tree. The process of curing the lemons, of which a full description appeared in the *Agricultural Gazette*, vol. iii, p. 666–669, is a simple one, and success depends very largely on the care taken in the gathering and handling of the fruit.

General Notes.

Admission of Students to Hawkesbury Agricultural College.

In connection with the selection of candidates for admission to the Hawkesbury Agricultural College, the Minister for Mines and Agriculture has had under consideration a proposal which it is thought will prove more satisfactory to candidates, and of less inconvenience to the Department than the system hitherto adopted, under which every applicant for admission, irrespective of educational attainments, was compelled to undergo entrance examination. The Minister has now decided that candidates who can produce a certificate of having passed the Civil Service or higher examination will be chosen to fill vacancies in the order of priority of application with, of course, as before, due regard to moral character and general fitness for the College course. For those candidates who have not passed any educational examination, arrangements will be made to hold an entrance examination, and the lads obtaining the requisite percentage of marks in such test will be admitted in the order of application.

Instruction in Sericulture.

In connection with the appointment of an expert in silk culture, the conditions upon which instruction will be imparted to pupils, with a view to extending the industry to suitable portions of the Colony, have now been decided. At the present time the Department is in possession of the white mulberry orchard belonging to the A.A. Company at Booral, near Stroud, where the expert is engaged in rearing and feeding the worms resulting from the eggs presented to the Department from Italy, as well as in improving the condition of the trees with a view to providing sufficient food of the necessary succulent character. The conditions are that a limited number of students be received at the Booral plantation for general instruction in sericulture, at the rate of £5 per annum, payable quarterly in advance; that such students provide their own board and lodging; that they be allowed to remain at the plantation for a period of twelve months, but, if they so desire, they may leave at the end of any quarter. If any student desires to remain longer than twelve months special permission must be obtained from the Minister. In the admission of students, preference will be given to those who satisfy the Department that they have facilities for carrying on the business of silk culture after the course of instruction is complete. All students will be required to comply with the rules and requirements of the instructor (Mr. Brady), and failing therein, upon the recommendation of Mr. Brady, they may be dismissed from the plantation. The first year to commence on the 1st September next. The above date has been fixed consequent on the lack

of accommodation, and the absence of facilities for carrying on the work, both of which wants are in course of provision, but in the meantime three ladies who have expressed themselves as willing to take matters as they are, have been permitted to enter upon a course free of charge for the balance of the present season, and are now hard at work at Booral, gaining practical experience of the work which is proceeding there.

The Silk Industry in Switzerland.

The United States Consul at Horgen, in a recent report, presents in a brief form the general result of the Swiss silk season of 1892–93, as obtained from a Statistical Review, published by the Association of Silk Manufacturers of the canton of Zurich.

A season or campaign, it is stated, comprises all the stages silk passes through, from the breeding of the worm to the marketing of the finished fabrics, including fluctuations in price, &c.

From the review mentioned, it is gathered that the world's total production of raw silk in 1892-93 was the largest on record, exceeding the production of the preceding year by 370,000 kilogrammes (815,480 English pounds), amounting to 12,529,000 kilogs. (27,613,916 pounds), while in the five years from 1881 to 1885 the crop averaged 9,631,874 kilos. (21,228,650 pounds), and in 1886 to 1890, 11,375,000 kilos. (25,070,500 pounds). The production of raw silk is steadily on the increase, caused by various agencies, among which are mentioned as of special interest:—

(1.) The large increase of silk culture in Syria and other parts of the Ottoman Empire, as a consequence of its encouragement and promotion by the administration of the Ottoman debt.

(2.) The great flexibility and practicability of extension of the eastern Asiatic exportation, the amount of which, as is well known, not only depends on the result of the crops, but also on the reigning market prices. In the interior of China and Japan there are always to be found large stocks—we might call them reservoirs—of silk, partly for home consumption and partly representing gold and silver. When prices of silk are high, parts of these reserves are thrown on the market for exportation, while as soon as prices drop these stores are closed again. This will explain why the amount of exportation was larger toward the end of the season than had been presumed at its beginning.

The silk crop of 1893 is estimated at 14,070,000 kilos. (31,018,722 pounds). In this total production Europe shares with 4,977,000 kilos. (10,972,294 pounds), the Levant with 923,000 kilos. (2,034,845 pounds), and eastern Asia with 8,170,000 kilos. (18,011,582 pounds).

An excess of consumption—which means a diminution of stock—in 1892-93 of 2,004,000 kilos. (4,418,018 pounds) will be only partly balanced by an increase of production in 1893 of 1,541,000 kilos. (3,397,288 pounds). If in the season of 1893-94 the consumption should proceed in the same proportion, the general stock would be further reduced about 463,000 kilos. (1,020,729 pounds), and even if consumption should fall to the average level of 1890-91 and 1891-92—11,800,000 kilos. (26,014,280 pounds)—the supply of the market would only approximately reach the figure with which the lively season of 1892-93 had opened.

As far as Switzerland is concerned, the importation, as well as exportation, of silk in 1892-93 (according to weight) manifested an ascending tendency

after a slight decline in the previous year, the importation of 5,042,000 kilos. (11,115,593 pounds), showing an increase of 14 per cent., and the exportation of 5,941,000 kilos. (13,097,528 pounds) an increase of 7 per cent. This is due, in the first place, to the larger transactions in the spun-silk industry, the materials of which show an increase of 25 per cent. in importation and of 20 per cent. in exportation; and, in the second place, to the increased import and export of raw silk. The export of silk thread, too, is on the increase. As to fabrics, a decrease of import is to be recorded, which is almost exclusively confined to piece goods and ribbons of pure silk, and may be ascribed to the interrupted commercial relations with France, *i.e.*, to a smaller purchase of merchandise from there. The import of half-silk fabrics, however, has considerably increased. The export of fabrics has remained stationary as to weight, a slight decrease in piece goods being counterbalanced by an increase in ribbons. The export of silk embroideries has dwindled down—in consequence of their neglect by fashion—to less than half of its former amount.—*Board of Trade Journal*, January, 1894.

Phylloxera Resisting Vines.

In view of the recent outbreak of phylloxera vastatrix in Victoria, the Minister for Mines and Agriculture, N.S.W., is taking timely steps to introduce from France seeds of the better known phylloxera-resisting stocks.

Seeds of the following varieties have been ordered:—Vitis Riparia, Vitis Rupestris, Solonis, York's Madeira, and Vitis Berlandeiri.

It may be mentioned that small quantities of these stocks are already being propagated at the Gosford Nursery, and in the course of time it is hoped the Department will have a sufficient supply to give our leading vinegrowers an opportunity to graft extensively on to these well tried phylloxera-resisting stocks.

American Wheats.

The Department has also received from Chicago half-bushel bags of some twelve varieties of the best wheat under cultivation at the experimental stations in the United States.

These will be planted at the experimental farm, Wagga Wagga, and when acclimatised, the resulting seed should prove a valuable addition to the strains of wheat at present being grown in New South Wales.

Trade with Canada.

With a view to furthering the opening up of commercial relations with Canada, in which direction some steps were taken by the Department at the departure of the Hon. Mackenzie Bowell, a number of samples of Australian wool, accompanied by catalogues, were in September last handed to Messrs. Burns, Philp, & Co., agents for the Canadian-Australian S.S. Line, for transmission to that country. In connection with this shipment the Department was recently advised by the agents that these samples safely arrived at their destination, and had been distributed, one box to the woollen mills at Sherbrooke, one to Dundas, one to Almonte, and the other one to the woollen

mills at Cornwall, near Montreal, these comprising the most important woollen industries in Canada. Messrs. Burns, Philp, & Co. express the hope, in which our readers will doubtless join, that the distribution of these samples will be attended with success, and be instrumental in promoting the development of the woollen trade between this Colony and Canada.

Insects Injurious to Stored Grain.

If any proof were required of the superiority and thorough effectiveness of bi-sulphide of carbon for the destruction of any of the known insects which attack stored grain, such is amply supplied in a Bulletin under the above title issued by the Delaware (U.S.) College Agricultural Experimental Station. This pamphlet gives the results of a number of practical experiments with stored grain of various kinds attacked by their respective pests. Thus wheat attacked by the grain beetle (*Silvanus surinamensis*, Linn.) and by the granary weevil—that generally found in flour—(*Calandra granaria*, Linn.); rice, by the rice weevil (*Calandra oryzae*, Linn.); peas, by the pea weevil (*Bruchus pisi*, Linn.); beans, by the bean weevil (*Bruchus obtectus*, Say.), and by the four-spotted bean weevil (*Bruchus 4-maculata*, Riley); wheat, corn, oats, barley, sorghum seed, and recently cow peas, by the angoumois grain moth (*Galechia cerealella*, Oliv.), have each and all of them been successfully cleared and the uninjured portions of the grain saved for market. In the course of the various experiments it has been proved that 1 oz. of the liquid to each 100 lb. of grain is sufficient, unless the grain is exceptionally badly affected, and that satisfactory results are obtained even where the receptacles in which the grain was placed were not air-tight. In such cases it has been found sufficient to cover the grain, after the liquid has been evenly sprinkled over the top, with a blanket or other similar material for about three hours, although a longer period is preferable. The grain is then screened and the dead insects thereby removed, leaving the grain perfectly clean. It may be mentioned that grain treated with this chemical is not in any way injured either for market or for seed, while the cost of the treatment is about 1 per cent. per bushel. There is, of course, a certain amount of danger incurred in the use of the bi-sulphide, but it may be used without fear, if the operator is ordinarily careful, provided *lights or fire are not brought near the liquid or the fumes from it.* An officer of this Department has used it regularly for the past four years without accident.

Profitable Dairy Stock.

From a paragraph in a recent issue of the *Shoalhaven Telegraph*, it appears that Mr. David Hyam scored as follows at the Kiama show:—Alderney or Jersey cattle for dairy purposes. Judges: A. Warden and T. N. Grierson. Alderney or Jersey bull, 3 years and upwards, D. Hyam; ditto ditto, 2 years and under 3, D. Hyam 1, G. Gray 2; ditto ditto, 1 year and under 2, D. Hyam 1 and 2; ditto ditto bull-calf, under 12 months, D. Hyam; ditto ditto cow, 3 years and upwards, D. Hyam 1 and 2; ditto ditto heifer, 2 years and under 3, that has not had a calf, E. M'Clelland 1, D. Hyam 2; ditto ditto heifer, 1 year and under 2, that has not had a calf, D. Hyam 1 and 2.

The following is the result of the butter tests at the above show:—

Mr. Hyam's Jerseys.

	lbs. Milk.	Butter Test.
Shamrock	$27\frac{1}{2}$	5·4
Zoe	27	5·8
Dollie	$20\frac{1}{2}$	7·2
		17·14

Average, 5·71.

Other Owners.

Queenie	31	3 9
Queen	$22\frac{1}{2}$	2·3
Rose	$29\frac{1}{2}$	3·0
Alice	$20\frac{1}{2}$	3·6
Twin	26	1·6
Lizzie...	31	3·2
Violet	33	3·5
Diamond	$34\frac{1}{2}$	2·6
Frosty	31	3·2
Beauty	$30\frac{1}{2}$	3·6
Easy	22	2·8
		28·53

Average, 2·59.

AGRICULTURAL SOCIETIES SHOWS, 1894.

Society.	Secretary.	Date.
Dapto A. and H. Society	A. B. Chippindale	Jan. 9, 10.
Clunes Agricultural Society	J. W. Brown	,, 17, 18.
Albion Park A. and H. Association	T. Armstrong	,, 17, 18.
Kiama A. and H. Association	J. Somerville	,, 25, 26.
Holt-Sutherland H. and I. Society	W. Douglas	,, 26.
Wollongong A. and H. Association	A. J. A. Beatson	,, 31, and Feb. 1.
Berry A. and H. Society	A. J. Colley	Feb. 6, 7, 8.
Gosford A. H. and I. Association	H. S. Bevrendge	,, 9, 10.
Luddenham A. and H. Association	K. Campbell	,, 13, 14.
Manning River (Taree) A. and H. Association	W. Plummer	,, 14, 15.
Lithgow A. and H. Society	M. Asher	,, 15, 16.
Shoalhaven (Nowra) A. and H. Association	R. Leeming	,, 15, 16.
Marulan P. and H. Society	H. Morrice	,, 23.
Kangaroo Valley A. and H. Society	H. Joyce	,, 25, 26.
Candelo A. and H. Association	C. H. Brooks	,, 27, 28.
Tumut A. and P. Association	W. H. Bridle	,, 27, 28.
Tenterfield P., A., M., and H. Society	J. Harker	,, 27, 28, and Mar. 1.
Port Macquarie A. and H. Society	A. E. Poutney	,, 28 and Mar. 1.
Lismore A. and H. Society	C. S. Connor	,, 28 and Mar. 1, 2.
Berrima District (Moss Vale) A., H., and I. Society	J. Yeo	Mar. 1, 2, 3.
Nepean District (Penrith) A., H., and I. Society	R. Benaud	,, 1, 2, 3.
Robertson Agricultural Society	R. J. Ferguson	,, 6, 7.
Uralla P. and A. Association	J. D. Leece	,, 6, 7.
Bega A. and P. Association	A. J. Wilson	,, 7, 8.
Inverell P. and A. Association	J. M'Ilveen	,, 8, 9.
Picton Agricultural Society	G. Bradbury	,, 8, 9.
Cobargo A. and P. Society	J. Graham	,, 13, 14.
Tumberumba P. and A. Society	W. Willans	,, 13, 14.
Glen Innes P., A., and M. Association	J. Denshire	,, 14, 15.
Goulburn Agricultural Society	J. J. Roberts	,, 15, 16.
Gulgong Agricultural Association	S. Turner	,, 16, 17.
Armidale (Combined Show), A. and P. Association	W. H. Allingham	,, 20, 21, 22.
Taralga A. and P. Association	J. J. Walsh	,, 21, 22.
Royal Agricultural Society (Sydney)	F. Webster	,, 21 to 27.
Braidwood P. and A. Association	G. F. Taylor	,, 22, 23.
Castle Hill A. and H. Association	F. H. G. Rogers	,, 26, 27.
Orange A. and P. Association	J. S. Thomas	,, 28, 29.
Walcha P. and A. Association	H. Chapman	April 4, 5.
Lower Clarence (Maclean) Agricultural Society	J. S. Dunnet	,, 4, 5.
Camden A., H., and I. Society	W. R. Cowper	,, 4, 5.
Gundagai P. and A. Society	W. E. Kyle	,, 5, 6.
Blayney P. and A. Association	G. H. Woolly	,, 5, 6.
Gundaroo P., A., and H. Association	J. Affleck	,, 6.
Namoi (Narrabri) P., A., and H. Association	J. Riddle	,, 11, 12.
Bathurst A., H., and P. Association	W. G. Thompson	,, 11, 12, 13.
Clarence (Grafton) P. and A. Society	T. Page	,, 18, 19.

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Society.	Secretary.	Date.
Wellington P. and A. Association	R. Porter	April 18, 19.
Hunter River (West Maitland) A. and H. Association	W. C. Quinton ...	„ 18, 19, 20.
Dubbo P., A., and H. Association...	G. H. Taylor ...	„ 24, 25, 26.
Warialda P. and A. Association	W. B. Giddes ...	„ 25, 26.
Mudgee Agricultural Society	J. M. Cox ...	„ 26, 27.
Macleay (Kempsey) A. and H. Association ...	H. R. Gray ...	May 9, 10, 11.
Gwydir (Moree) P. and A. Association	J. G. Cohen ...	„ 9, 10.
Upper Hunter (Muswellbrook) A. and H. Association	Price Healey ...	„ 16, 17.
Upper Manning (Wingham) A. and H. Society...	J. J. Herkes ...	„ 16, 17, 18.
Hornsby, Thornleigh, Pennant Hills, &c., H. Association	H. Epthorp ...	„ 23, 24.
Cumnock P. and A. Association	W. Newmarch ...	„ 24.
Warren P. Association	F. C. Thompson ...	June 7, 8.
Cobar P. and A. Association	A. Roxburgh ...	„ 13, 14.
Riverina (Jerilderie) P. and A. Society	J. Fulton... ...	July 24, 25.
Forbes P., A., and H. Association...	W. G. Dowling ...	Aug. 9, 10.
Northern (Singleton) Agricultural Association ...	C. Poppenhagen ...	„ 15, 16.
Cowra P., A., and H. Association...	S. Wright... ...	Sept. 5, 6.
Burrowa P., A., and H. Association	J. F. Clifford ...	„ 13, 14.

Secretaries of Societies are asked to forward dates of forthcoming Shows as soon as decided.

[3 plates.]

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SYDNEY: CHARLES POTTER, GOVERNMENT PRINTER

Useful Australian Plants.

BY J. H. MAIDEN,
Consulting Botanist.

No. 10.—The Tallow-wood.

(*Eucalyptus microcorys*, F. v. M.)

Other Vernacular Names.—Usually in New South Wales it bears the one name of tallow-wood, which has been given to it owing to its greasy nature, which is most marked when freshly cut. In Queensland it is known as "turpentine tree," and also as "peppermint," the foliage being remarkably rich in volatile oil. In the same colony it also goes under the name of "red stringybark," owing to its reddish fibrous bark, and not because of the colour of its wood, as are red stringybarks in New South Wales.

Aboriginal Names.—By the aborigines of the Richmond River, New South Wales, it used to be called "Wangee." Those of the Brisbane River, Queensland, used to call it "Tee."

Botanical Name.—The name *Eucalyptus* has been already explained. *Microcorys* is made up of two Greek words, signifying "a little helmet," and is in allusion to the comparative smallness of the cap (*operculum*) of the flower.

Flowers.—Mr. Forester Martin observes that tallow-wood flowers in August and September (October should be added—J.H.M.) in his district, and that the flowers are much sought after by bees. I may mention that, on behalf of the beekeepers of the Colony, the Department is busily collecting information in regard to the best flowers for bees and the periods during which they are out. As is well known, many eucalypts have irregular flowering periods, and the Department is trying to ascertain the period in each district for particular years.

Fruit.—The fruits are comparatively long and narrow. Their shape is brought out in the drawing, and, if this be mastered, a fruit-bearing tallow-wood twig cannot be mistaken for anything else.

Leaves.—The fresh leaves of the tallow-wood yield 1·960 per cent. of an essential oil of an acid reaction, and a specific gravity of ·896 (Staiger). Other figures give 375 oz. to the ton of leaves, which equals 1·046 per cent.

Schimmel & Co., of Leipzig, in their October, 1893, *Bericht*, give the specific gravity of this oil at 15° C., at as high as ·935, and give its boiling point at 160° and 200°. They further state that it contains Cineol (*Eucalyptol*).

The oil is stated to have a not very agreeable odour, but it probably might be found useful in varnish-making. I hardly know, at present, how to reconcile the above statement with the following:—

"The oil of *E. Baileyana* and those of *E. microcorys* and *E. citriodora* are very similar to one another. They possess a magnificent melissa-like

odour. It is thought they will prove to possess extraordinary practical value. Chemically, the three oils are quite characteristic. Neither of them contains a terpene, but they consist of a ketone ($C_{10}H_6O$), smelling like melissa, and a body that is probably an alcohol ($C_{10}H_{18}O$?), which possesses a beautiful odour resembling that of geranium."—*Messrs. Schimmel & Co., of Leipzig, in Pharm. Journ.* [3], XVIII, 907.

As regards the oil of *E. citriodora*, I may mention that its composition has since been determined. I would very much like to have an opportunity of examining a guaranteed oil of *E. microcorys*. If any reader of the *Gazette* will forward me such a sample, I will promise to furnish an exhaustive report on it. Distillers of eucalyptus oil are on the look out for new trees in order to see if the products they yield are of improved value. Why not try the tallow-wood (*E. microcorys*)? It is certainly worth testing, and there may be money in it.

Exudation.—The "gum" or kino from the tallow-wood is one of the most interesting of such substances. I do not think it is of such medicinal value as those from most other eucalypts, but it is of scientific interest, and the following account of some specimens examined by me a few years ago form the first investigation into the substance:—

a. Sample of Kino from New England, N.S.W., received 1886.

Kino of this species is less vesicular than that of *E. maculata*, but almost as readily reducible to a powder. This particular specimen is in small pieces, for the most part of the size of currants. In bulk it looks remarkably like a parcel of uncut garnets. Owing to its friability, the bright fractures become dulled with very little friction. Colour of powder, orange-brown.

To cold water a yellow solution is yielded, with a slight tinge of brown, having a turbid residue of a dirty yellow colour, with a few black or dirty particles. Eventually almost everything dissolves, with the exception of a little accidental impurity.

It was analysed October, 1888, with the following result:—

Catechin and tannic acid	81·2
Resin	trace.
Ligneous matter, &c....	·4
Moisture	18·1
Ash	·3
	100·0

Tannic acid determination (Lowenthal), 54.349 per cent.

b. A sample from Uralba, Wardell, N.S.W., collected May, 1891, has also been examined. It is a new sample, with no important differences from the foregoing.

It was analysed August, 1891, with the following result:—

Catechin and tannic acid	76·39
Resin	·08
Ligneous matter, &c.	·87
Moisture	20· 4
Ash	1·54
	100·00

Tannic acid determination (Lowenthal), 50·45 per cent.

The presence of resin in a weighable quantity in this kino is worthy of notice.

c. Two samples from Queensland, received from Mr. F. M. Bailey, F.L.S., Colonia Botanist.

The physical description of the preceding sample will apply here. In cold water the layer at the bottom of the vessel becomes, if undisturbed, of the colour of treacle. The tint is precisely the same as that of a guaranteed sample of *Pterocarpus marsupium* kino received from India. It leaves a small quantity of a brown residue, which produces turbidity if disturbed.

Water at 100° C. (1 grm. to 1 litre) yields a beautifully clear solution, of the colour of colza oil. This remark applies also to the preceding sample.

It was analysed October, 1888, with the following result:—

Catechin and tannic acid	82·1
Resin	trace.
Ligneous matter matter, &c.	·5
Moisture	17·2
Ash	·2
	100·0

Tannic acid determination (Lowenthal), 56·888 per cent.

Mr. Staiger says of a Queensland sample of this kino :—"The specific gravity is about 1·395, and the percentage of tannin 53·33. The solution in water when evaporated yields brownish scales."

Bark.—The bark (often of a "corrugated" appearance), is sub-fibrous, of loose and even woolly texture. In colour it is of a sort of brick or rusty red, and is persistent even to the smallest branches.

The Timber.—Tallow-wood is one of the most valuable timbers the Colony produces. It is strong and durable under or above ground. Its colour is yellowish-brown or yellowish, and, like many other timbers, darkens with age. Its greasiness has been referred to elsewhere.

It is used by wheelwrights for naves, felloes, and spokes (W. Hill), cogs, also for flooring, *e.g.*, in ballrooms; for this latter purpose it is selected on account of its greasy nature. It is also used for the floors* of a number of large Sydney buildings. It is used for the decking of bridges, bridge work in general, and culverts.

It is used for pickets, also for turnery, *e.g.*, the turned pillars of verandah posts, for mouldings and architraves, and for all building purposes requiring strength and durability, *e.g.*, slabs, piles, and posts, and for sawn stuff generally. Mr. Forester Deverell, of Glen Innes, knows slabs in a hut sound now after eighteen years in use. It would not be possible to enumerate all the uses to which this valuable timber is put in New South Wales and Queensland.

The following interesting notes by Mr. Forester Brown, of Port Macquarie, I give, even at the risk of a little repetition :—"Tallow-wood is suitable for any dry work. It is easy to work on account of its greasy nature, and is the best timber for any purpose where a smooth surface is required, particularly for a ballroom floor. All that is required to revive the greasy nature for dancing is to spread a few loads of the sawdust on it for a day or

* Mr. Forester Martin says it is not used for flooring-boards in his district.

two; we then have a perfect floor. It does not burn very readily; white ants do not attack it as readily as blackbutt, &c. It is a good timber for bridge decking; it is not good for rafters and studding for buildings, as because of its greasy nature the nails will draw. It is the only timber we have of a greasy nature, and it has the effect, when being worked, of cleaning and keeping clean tools such as saws, &c., which have got gummed in working other timber. It is fairly durable in fresh water. Many years ago, when ink was short, the farmers on the rivers used to brand their bags of produce by means of an ink made by steeping chips of tallow-wood in water for a day or two (presumably in contact with iron). Tallow-wood is generally preferred to blackbutt for the same uses."

The notes of Mr. Forester Pope, of Murwillumbah, Tweed River, may be given here: "The timber, if left alone by white ants, will last almost any number of years above or below ground. It is hard, strong, and fairly easily worked. The Roads Department use a quantity of it here for decking in culverts, bridges, &c., and it seems to stand traffic well. It is difficult to split because of the presence of a greasy or waxy substance, making it a tedious matter to get a wedge to "draw," but when split it makes splendid posts and rails. It does not burn well, as when burning it exudes a kind of juice which puts the fire out."

Mr. Forester Pope says that in his district the bark is always riddled within a quarter of an inch of the sapwood with white ants. "This is a great drawback to the value of the timber; it appears to suit them exactly. There is generally a huge nest of them in the head. It seems to be the first timber they attack."

The timber shows black stains where nails are driven, unless it is well seasoned.

Mr. Forester Rudder says that he knows of no timber that suffers so little from exposure after being cut down. Even if left for many years the mature wood remains as fresh as in the growing trees.

It is sometimes urged against tallow-wood that it does not hold nails well. It also shrinks, but the effect of this can be guarded against by seasoning, which is rather a longer process than with most timbers. It is, however, worth a little trouble, as it fetches a higher price than most other hardwoods.

According to Mr. Forester Rotton, tallow-wood charcoal is considered one of the best for the smithy.

A drawback to this valuable timber is the liability it shares with blackbutt to what are called "pin-holes." These are caused by the boring of the larvæ of a small beetle probably belonging to the genus *Anobium*, and possibly to an introduced species. The insect damages a large number of colonial timbers, being chiefly found in the sapwood of very many. It is rather difficult to destroy.

Tallow-wood for Paving.—I believe tallow-wood to be an excellent wood for paving, but we really know but very little about the relative merits of colonial hardwoods for paving. We have miserably few data, and these are not satisfactory, for it is manifestly absurd to compare (say) blackbutt and red gum, without having some idea that the timbers were procured under something like comparable conditions. In heaps of blocks for paving I have observed every possible quality of the same timber; in order to obtain some

valuable data in regard to the merits of a timber, it is manifest that the observations must be conducted with every possible scientific safeguard.

Mr. R. W. Richards, the Sydney City Surveyor, has, in a recent report, given the following information in regard to certain tallow-wood blocks, but unless duplicates were preserved at the time of laying, I am afraid that we are not in a position to fully comprehend what these results mean:—

Block No. 1 was taken from Pitt-street; width of carriage-way, 36 ft.; position of block, 18 ft. from kerb; original depth, 6 inches; average depth on removal, $5\frac{3}{8}$ in.; laid in July, 1881; removed December, 1892; width of joint, $\frac{3}{4}$ in.; rate of wear per annum, $\frac{1}{15}$ of an inch.

Block No. 2 was taken from George-street; width of carriage-way, 64 ft.; position of block, 30 ft. from W. kerb; original depth, 6 in.; average depth on removal, $5\frac{2}{3}$ in.; laid in October, 1883; removed December, 1892: width of joint, $\frac{1}{2}$ in.; rate of wear per annum, $\frac{1}{16}$ of an inch. I must refer my readers to the original report; but the results obtained place this timber in a favourable light, and it is one of six timbers recommended by the City Surveyor for paving.

Mr. Richards' opinion of the value of tallow-wood is more definitely stated in the sentence:—"At the time of writing, all the old blocks have been removed, and the paving relaid with blocks of blackbutt and tallow-wood."

Tests of Strength of Tallow-wood.—Following are the particulars of some experiments on tallow-wood, conducted at the Railway workshops at Newport, Victoria, in 1884. The samples tested were each 7 ft. in length by $1\frac{7}{8}$ in. square; the distance between the bearings was 6 ft., and the weight was gradually applied in the centre till the sample broke. The timber was of New South Wales growth, and seasoned at least 12 months.

The weight of each sample was $9\frac{3}{4}$, $10\frac{1}{2}$, $10\frac{1}{4}$ lb.

Average weight per cubic foot, 59·43 lb., and therefore its specific gravity was 0·952.

The breaking weight of each sample was 6 cwt. 2 qr. 20 lb., 6 cwt. 2 qr. 24 lb., 7 cwt. 1 qr. 17 lb. Therefore, the average breaking weight of the samples was 776·3 lb. The deflections at the points of rupture were $5\frac{1}{4}$, 4, and $4\frac{1}{2}$ inches respectively. The average specific strength was given at 2,119.

Education in Colonial Timbers.—Tallow-wood is a timber that has suffered much at the hands of ignorant or designing persons, who have substituted inferior timbers, bearing a resemblance more or less close to it.

White mahogany (*Eucalyptus acmenoides*) is often passed off for tallow-wood. The former is a valuable and durable timber, but still much inferior to tallow-wood. Young tallow-wood is far from being as good as old timber. Mr. Forester Deverell complains that tallow-wood is not extensively used in his district, and justly considers that this "is from ignorance, and also from timbers of much inferior quality being more easily got." At the same time, tallow-wood is one of the easiest of colonial hardwoods to recognise, and there should be no real difficulty in the matter. Of course an incompetent person can be "let in" whether the article is colonial hardwood or any other material of construction, and I cannot help thinking that the cry of

the similarity between colonial timbers is a little overdone. The cry is often employed by incompetent persons to distract attention from their ignorance in diagnosing colonial timbers. I think the time has now arrived for officers in Government or municipal employment who have, in the ordinary course of business, to diagnose hardwood, to pass an examination in the subject, just as professional men have to do in regard to other materials of construction. The pity is that we have so many men here learned in European and American timbers, and only possessing a rule-of-thumb knowledge of the timbers of the country in which they were born, or in which their lot is cast. How the knowledge shall be imparted or tested is a mere matter of detail; that the reform is desirable is undisputed, and I hope I may live to see it carried out. Knowledge of colonial timber can only be obtained by handling it as sawn stuff, and by careful observations as to the circumstances under which it grows in the forest. The subject is not an easy one, and I don't intend to say it is. There is no more a golden road to a knowledge of colonial timbers than there is to a knowledge of Greek. Very often the man who knows least about our colonial timbers is readiest to assail them. We must suspend our judgment with regard to the absolute merits of many of them, and what I plead for is a systematic attempt to get at the value of each timber—to test it from various points of view. Many of our timbers have not had a fair "show." These are times of reduced expenditure, but I would like to see £10,000 spent on a proper survey, examination, and test (not merely of strength), of colonial timbers. The sum mentioned might be spread over five years. I am sure that such a sum would be a justifiable expenditure in regard to a national property which is reasonably valued at millions of pounds.

Size.—It attains a height of 100 to 150 feet, and a maximum diameter of 6 to 8 feet. Mr. Forester Martin, of Gosford, gives the height of trees in his district at from 100 to 150 feet, and diameter at from 2½ to 4 feet. He adds, "The trees appear to be healthful, and the young trees make good growth. Very large trees are rarely sound at heart." Up to 10 feet in girth in the Glen Innes and Tenterfield districts.—(Mr. Forester Crowley.) The height of 150 feet for this tree is attained in some places in the county of Richmond, according to Mr. Forester Crowley.

Mr. Forester Rudder says that in his district its approximate height is about 140 or 150 feet, and its diameter about 3 feet, but that it not infrequently attains a height of 170 or 180 feet, with a diameter of 5 and even 6 feet, diameters of 4 or 5 feet being common.

Mr. Fawcett reported to Baron von Mueller (*Eucalyptographia*) that tallow-wood trees attained a height of 300 feet on the Richmond River, but I have not been able to confirm this. It is, of course, very easy to over-estimate the height of tall trees. I should be glad if correspondents would favour the Department with guaranteed measurements of the size of exceptionally large tallow-wood trees. We want (*a*) height from ground to top of highest branch, (*b*) height from ground to where lowest branch springs, (*c*) girth at 3 and 6 feet from ground respectively.

Very large trees are generally hollow, but, as a rule, those under 3½ feet in diameter are sound. This should be borne in mind, for trees are like men in that, after a period of maximum vigour and strength, they become less strong, and finally fall into decay.

Dr. Joseph Bancroft states that this valuable tree is protected by legislative enactment in Queensland from being cut by timber-getters.

Distribution.—It is generally supposed that the tallow-wood does not come further south than the Hastings River. The most southerly locality is, however, Cooranbong, 26 miles south of Newcastle. Mr. Forester Martin, of Gosford, says: "The only place in my district in which tallow-wood is to be found is an area of about 4,000 acres in the neighbourhood of Cooranbong. I believe that tallow-wood crops up again at Port Stephens, so that there is a gap between the two places where tallow-wood does not grow."

Trees frequently skip over extensive districts in this way. For instance, in the article on black-wood it was shown how in its distribution from south to north this tree entirely skips over the Sydney district."

Mr. Martin says: "The tallow-wood here grows in patches—is not plentiful. It appears to like well-sheltered, well-drained localities, such as banks and creeks, heads of gullies, and spurs of ranges. Soil here sandy loam, enriched with leaf-mould."

Mr. Forester Rudder, who is stationed at Booral, reports that tallow-wood occurs more or less all through his district, except on its higher elevations in its north-western parts; but it is most abundant between Bulladelah and Gooloongolook, and in the southern parts of the parish of Alfred, commencing about 14 miles in a northerly direction from Dungog. The best and largest timber is usually found in undulating, scrubby, forest country.

Tallow-wood extends from about 8 miles south of the Macleay River to about John's River, a distance of about 45 miles to the south; inland it extends about 10 miles. In abundance it is about next to blackbutt, giving an average of about two trees per acre, which are about 20 to 25 feet to the first branch.—(Forester G. R. Brown.)

On the watershed between the Blick's River and the Nymboida (practically about midway between Grafton and Armidale) is a magnificent forest of mature tallow-wood, with blackbutt and a little turpentine. This is a maiden forest, full of grand timber, but practically inaccessible under present circumstances, and with the poor local demand for hardwood. The get-out for timber of this forest would be along the range to the Long Flat, about 1½ mile from Perrett's (Tyringham).

Mr. Forester Pope, of Murwillumbah, writes:—Tallow-wood, with the exception of the common box, grows more abundantly in this district than, perhaps, any other eucalypt. It is found uniformly distributed through all forest land at about four trees to the acre. Other hardwoods are in patches, and favour certain spurs, but one never goes many yards in forest land without finding several tallow-wood trees.

Mr. Forester Crowley, of Casino, states that tallow-wood is found plentifully scattered all over the flat country in the county of Richmond; it is also growing in a few places in the counties of Rous, Drake, and Buller.

Mr. Forester Deverell, of Glen Innes, states that it is found in all stages of growth on the eastern falls of Glen Innes and Tenterfield districts in fair quantities.

The notes on New South Wales localities for tallow-wood are supplemented by the following interesting tabular statement, which has been furnished by the Forest Department. Tallow-wood extends from Cooranbong, the most southerly locality in New South Wales, as already stated, to southern Queensland, being confined to the coast districts and tablelands.

In Queensland it is found in the forest near the Logan, Brisbane, and Pine Rivers.—(W. Hill.) A common tree on the hills of southern Queensland.—(F. M. Bailey.)

TALLOWWOOD (*Eucalyptus microcorys*).

No. of F.R.	County.	Area of F.R. in acres.	Class.	How distributed. No. of trees per acre.	How distributed. Over area of F.R.	Size Girth. ft.	Size Girth. in.	Quality.	Remarks.
1,120	Buller, Rous, and Drake...	80,788	A	3	10,000	6	6	Fair to good.	A fair growth generally of young tallowwood trees.
24	Clarence	2,500	A	1	500	6	0		
26	„	1,040	A	1	500	6	0		
243	„	7,600	C	6	2,000	7	0		
260	„	71	C	2	20	7	6		
353	„	4,480	C	2	1,000	6	0		
979	„	740	A	1	979	7	0		
1,101	Clarence and Richmond...	19,016	A	1	4,000	6	0		
1,662	Clarke	44,900	C	4	1,000	6	0		
537	Drake	38,400	C	2	2,900	7	6		
6,264	„	9,005	A	5	9,005	12	0		
112	Dudley	2,453	A	2	1,000	7	0		
158	„	79,680	C	3	35,000	7	0		
3,753	„	16,000	C	1	2,000	8	6		
136	Fitzroy	12,440	A	1	6,000	8	0		
355	„	5 660	C	1	5,000	6	0		
642	„	30,043	C	1	5,000	7	6		
10,786	„	18,560	A	2	2,000	7	6		
46A	Gloucester	26,700	A	2	9,000	10	6		
1,608	Gresham	24,960	C	12	24,960	9	0		
1,433	Gough	12,800	A	10	1,000	9	0		
33	Macquarie	2,100	C	1	2,100	7	6		
34	„	10,000	A	2	6,000	10	6		
100	„	7,472	A	2	3,500	8	6		
144	„	12,262	A	1	12,262	10	6		
233	„	280	C	1	280	9	0		
234	„	610	A	1	610	9	0		
235	„	3,854	C	1	2,000	9	0		
46	Northumberland... ...	15,954	C	1	1,000	7	0		
70	„	33,186	C	1	2,000	7	0		
111	Raleigh	3,590	A	1	3,000	9	0		
121	„	15,904	A	1	8,000	7	6		
4,780	„	2,500	A	1	2,280	8	0		
10	Richmond...	1,100	A	1	900	6	0		
11	„	2,800	A	2	2,000	5	6		
12	„	4,800	A	1	2,800	7	8		
13	„	2,800	A	1	2,000	7	8		
625	„	3,900	C	1	3,000	7	6		
894	„	6,400	A	1	5,000	8	9		
1,137	„	12,610	C	2	8,000	7	6		
62	Rous	2,700	C	5	1,700	9	0	Faulty ..	
249	„	16,661	C	3	10,000	10	0	„ ...	
258	„	1,280	C	2	1,000	10	0	Fair ...	
864	„	930	A	10	600	9	0	„ ...	
4,353	„	7,701	C	3	14,000	10	6	„ ...	

Eucalyptus microcorys, F. v. M.

(11658-94) "The Tallow Wood."

Propagation.—From seed. In the warmer coast districts of the Colony it flourishes exceedingly. It is, in fact, one of the most rapid growers of our eucalypts. It is certainly one of our timber-trees which must be considered in any national scheme of forest conservation. I would like to draw the attention of those who cultivate trees for ornamental purposes to the merits of the tallowwood. It springs up quickly, and has a shapely, umbrageous head of very neat foliage. It is many years before it begins to get gaunt and show itself a forest tree. It is a change after the everlasting camphors, *Tristanias* (*Lophostemon*), *Pittosporum*, and so forth. I have grown several of them, and have been instrumental in getting others to try them, and, I believe, they have always given satisfaction as a well-formed shade tree. I do not know of any drawback the tallowwood may possess for this purpose.

The *Tropical Agriculturist*, of Ceylon, quoting an Udapussellawa correspondent, says:—"Of all Australian trees introduced into Ceylon, the tree which has grown beyond all compare is *E. microcorys*. A specimen 8 years old was 5 feet 4 inches in girth, and tall in proportion."

TALLOW WOOD.

Reference to Plate (page 297).

A. Leaf showing venation (a little diagrammatic).
B. Flower buds.
C. A flower. (Notice that the outer stamens are without anthers.)
D. Fruits.

The "Saffron"—or "False Star Thistle."

(*Kentrophyllum lanatum*, D. C. et Dub.)

A Noxious Weed which is Spreading.

By J. H. MAIDEN.

Other Vernacular Names.—As people usually call this "Star Thistle," I have simply prefixed the word "false" for a reason indicated below. Baron von Mueller proposes the name "Saffron Thistle" for it. It is, of course, open to the objection that it has nothing to do with saffron; its congener (*C. tinctorius*) is the well-known safflower of India, sometimes said to be used for adulterating saffron. But in adopting the name saffron thistle, I have taken into account the fact that in the illustrated work on thistles (by Baron von Mueller), issued by the kindred Department of Agriculture of another Colony, this name is employed, and it would be a convenience to adopt a uniform vernacular nomenclature for the pest. But whether the public of these two great Colonies will take the slightest notice of these benevolent efforts to save confusion, time alone will tell. My own opinion is that they won't, and having started to call it "Star Thistle," star thistle it will remain to the end of time. It is called "Chinese Thistle" in the Gunnedah district, and "Yellow Chinese Thistle" (to distinguish it from the "Pink Chinese Thistle," *Centaurea calcitrapa*) in the Grenfell district. But the Mongolians are not responsible for its introduction.

Botanical Name.—*Kentrophyllum*, *kentron*, a sharp point, *phyllon*, a leaf, in allusion to the prickly leaves; *lanatum*, woolly (referred to below).

Synonym.—*Carthamus lanatus*, Linn. By many authors at the present day (notably Bentham and Hooker, *Genera Plantarum*), *Kentrophyllum* is included under *Carthamus*, of which the best known species is *C. tinctorius*, the safflower of India.

Following is the earliest record I can find of the Saffron or False Star Thistle in Australia:—"Woolly Kentrophyllum (*Kentrophyllum lanatum*, D.C.), a native of the Mediterranean coast; a great nuisance. It is of modern introduction. Cattle and sheep do not eat the plant, and its extension becomes very rapid, especially in the north and south. In 1887, the Legislature passed an Act for preventing the further spread of this thistle, but which was then erroneously thought to be the true Star Thistle, *Centaurea calcitrapa*. The further spread of the true Star Thistle should also be prevented." (Schomburgk, *Annual Report Botanic Gardens, Adelaide*, 1888, p. 23.)

The South Australian Act referred to is No. 409, assented to 9th December, 1887, and its title is "An Act for amending the Act No. 26 of 1862, and for preventing the further spread of the Star Thistle."

Mr. Albert Molineux, General Secretary of the Agricultural Bureau of South Australia, says of it: "*K. lanatum* is eaten to some extent by stock, and it might make ensilage; it is not worse than *Onopordon acanthium* (true Scotch thistle)." I hope, however, this will not convey the impression that it is anything but a real nuisance.

"*Star Thistle as Fodder.*—Mr. Magarey, Narracoorte Branch, Agricultural Bureau, S.A., noticed a query in the report of the Burra Branch in the Journal for April as to whether star thistles had ever been utilised as food for any animal, reported that he had mown and cocked a large quantity during the dry weather; that he had left it in cock till the rains came, when the sheep took to it, and have now eaten nearly all of it, and which leads him to believe that it would make excellent silage. The Chairman stated that from observations he believed that the seed would be very suitable for poultry." (*Journal Bureau Agric.*, S.A., i, 64, July, 1890).

This is a meritorious attempt to utilise a weed-pest, which, I regret, is so abundant in the sister colony. I would, however, recommend that uncompromising war be waged against it; that it be destroyed utterly. In cocking and carrying there is great danger of the seeds flying about and infecting clean land.

In Victoria there is in force a lengthy Act "To consolidate the law relating to the Eradication of Thistles," No. MCXLV, 10th July, 1890. Clause 3 gives a list of the thistles and allied plants included in its operation, but *Kentrophyllum lanatum* is not included in the list. It is, however, described and figured in the "Illustrated Description of Thistles, &c., included within the Thistle Act of 1890" (Department of Agriculture, Melbourne, 1893), so it has presumably been proclaimed a thistle under clause 3 of "An Act to amend the Thistle Act, 1890" (No. 1,337, 6th November, 1893). Land-owners, lessees, or occupiers are, under these Acts, to destroy thistles under a penalty not exceeding twenty pounds.

Popular Description.—A prickly plant, growing in bushy masses, and attaining a height of 2 or 3 feet. The flowers are yellow, and are surrounded with prickly clasping leaves almost of the same shape as those which clasp the stem. The stem is a little furrowed and, in this Colony, usually more or less silvery in appearance; plants growing in Europe are greener. The plant, particularly the upper portions of it, is more or less thinly-woolly, or rather spider-webby. Perhaps these few notes will supplement the plate in making the identity of the thistle clear to every farmer.

Botanical Description.—A botanical description will only be understood by botanists, and is perhaps unnecessary here. Those who desire the original description will find it in De Candolle's *Prodromus*, vol. vi, p. 610 (1837), while a botanical description in English will be found at page 17 of Baron von Mueller's *Illustrated Description of Thistles*, Melbourne, 1893.

In Moloney's "Sketch of the Forestry of West Africa," p. 376, I find under *Carthamus lanatus*, "Blessed Thistle" of the Parisians, said to possess sudorific, febrifuge and anthelmintic properties, Mérat et Sens, *Dictionnaire Médicale*, tome ii. p. 115. "Widely cultivated." The last statement is apparently taken from Oliver's "Flora of Tropical Africa," vol. iii, p. 439. Why it is "widely cultivated" I do not know. It may be that the seeds yield oil. It is closely related to the Safflower (*Carthamus tinctorius*), but contains very much less colouring matter. But I recommend Australians not to attach the slightest commercial importance to the supposed medicinal or tinctorial properties of our wretched *Kentrophyllum*.

How to get rid of it.—It is an annual, and the only way to get rid of it is to cut it before it comes into full flower, and then burn it. Landowners should not be content with cutting it, as the dried plant may lame or otherwise injure sheep, &c., and a few seeds may escape destruction. It is manifest that united action should take place in dealing with the pest, for if there be an infested paddock in a district, the wind will waft the seeds like little shuttlecocks into the surrounding land. The pest is not yet so prevalent in this Colony as it is in South Australia and Victoria, and it is to be hoped that landowners will eradicate it on the principle that "a stitch in time saves nine."

Where found.—This plant is a native of the Mediterranean region (Europe and Africa, and South West Asia). It has found its way into most temperate and warm regions of the world.

As regards this Colony, the Secretary of the Albury Pastures and Stock Board reports: "The star thistle is all over the district in patches."

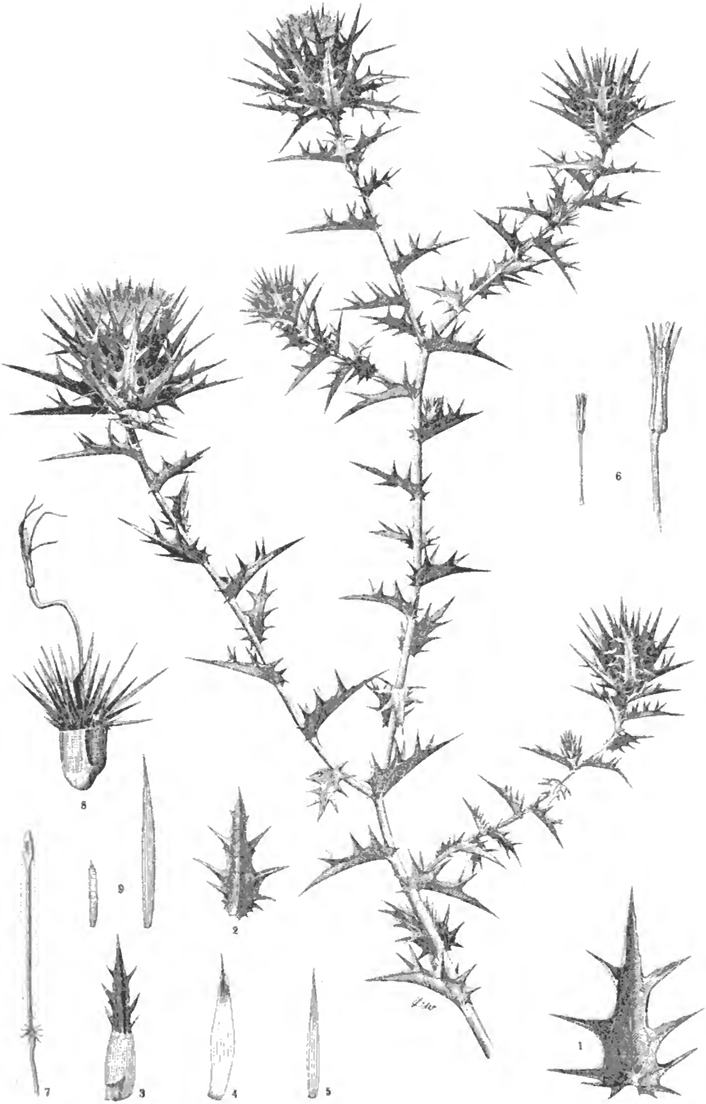
Mr. Forester Harris sends it from Gunnedah, saying: "It grows in bushes to the height of about 3 feet, with a diameter of about 5 feet, and is spreading rapidly. On ground that this bush covers no grass will grow."

It has also been reported by Mr. Forester Postlethwaite from Grenfell, and I have received it from other parts of the Colony.

THE SAFFRON THISTLE.

Reference to Plate (page 300).

1. Stem-clasping leaf.
2, 3, 4, 5. Showing all the stages from a floral leaf to a bract.
6. Individual florets.
7. Anther showing bristly appearance at upper part of filament.
8. Fruit, crowned with the pappus and the remains of a floret.
9. Extreme forms of the scales of the pappus.



Kentrophyllum lanatum, D'C. et Dub.

(110 E3-94)

"The Saffron Thistle or False Star Thistle"

Australian Sandarach.

By J. H. MAIDEN.

Introductory.—It is a matter of common observation that a number of raw vegetable products of more or less importance are going to waste in Australia, simply because our people are ignorant of their properties and value. I can hardly cite a better instance than that of Australian Sandarach. Here we have a product absolutely and entirely identical in chemical and physical properties with a well-known article in regular demand. The price of this article at London auction sales is shown by the figures I give below [*Appendix* A], while its cost in Sydney is very much enhanced; and yet we actually import from Algeria, *via* London, at this high price, what is common enough in parts of New South Wales, and to be had for the gathering. The trees from which this resin (for Sandarach is a resin), exudes are the well-known Cypress Pines of this Colony, some species of which are found in the coast districts and table-lands, but they are far more largely developed in the drier parts of the Colony.

The collection of Australian Sandarach is one of those minor industries which could be readily undertaken by a family of children. As the resin flowed from the Cypress Pines, it could be accumulated in clean dust-proof tins until a sufficient quantity was obtained to be sold to the local storekeeper, who would again sell to the wholesale chemist, or wholesale oil and colourman of Sydney. Sandarach is usually graded. There would be no difficulty in grading locally our local product, while any surplus available for export could be shipped without grading if found expedient.

I have no means of getting at the consumption of Sandarach in this Colony, but we ought to be able to supply the local demand and have a good surplus for export.

With these introductory remarks, I will give some further information in regard to Sandarach and Australian Sandarach, based upon a paper "On Australian and Tasmanian Sandarach," written by me and published in the Proceedings of the Royal Society of Tasmania in 1889. I do hope that educated men who may read what I have to say, and whose inclinations or duties carry them into districts where the native Cypress Pines grow, will take the trouble to encourage settlers and others to collect the product referred to.

Notes on Sandarach.—The Sandarach or gum juniper of commerce is the product of a *Callitris* (*quadrivalvis*), which grows in North Africa. The following summary of its uses is taken from Morel (*Pharm. Journ.* [3] viii, 1,024): "According to Gubler, the Arabs used it as a remedy against diar-

rhœa, and to lull pain in hæmorrhoids. The Chinese used one kind (*C. sinensis*) as a stimulant in the treatment of ulcers (as promoting the growth of flesh), as a deodoriser, and to preserve clothes from the attacks of insects. In Europe it is used very little in medicine. It is most frequently employed as an ingredient in varnish, to increase its hardness and glossiness. It is used also as a fumigant, and in powder ('pounce') to dust over paper from which the surface has been scraped, to prevent the ink from running. It rarely enters into the composition of plasters."

Ordinary Sandarach exudes naturally, but the practice in Northern Africa is to stimulate the flow, making incisions in the stem, particularly near the base, and this hint might be borne in mind by our people.

When our Cypress Pines are wounded, the resin exudes in an almost colourless, transparent condition. It has obviously high refractive power, and is much like ordinary pine resin in taste, smell, and outward appearance, when the latter is freshly exuding. This transparent appearance is preserved for a considerable time, the resin meantime darkening a little with age. Old samples possess a mealy appearance, but this is merely superficial. The origin of this appearance has been explained as follows in regard to *Sandarach*, and doubtless the simple explanation holds good here:—"The surface of the tears appears to be covered more or less with powder, but this character is not to be attributed, as alleged by Herlant (*Etude sur les produits résineux de la famille des conifères*, p. 38), to the friction of the fragments one against another, but as has been ascertained by a microscopical examination by Dr. Julius Wiesner (Die chemisch-technisch verwendte Gummiarten, *Harze und Balzame*, 1869, p. 129), to the unequal contraction of the resin while drying, resulting in a mass of fissures that form, as in the case of several kinds of copal, facets that gradually separate from the mass and constitute the 'powder' of many authors." (Morel, *op. cit.*) Evidence against Herlant's supposition is also found in the fact that resins of the *Sandarach* class are nearly *white on the trees* after they have been exuded some little time, showing that the appearance is brought about by exposure to the weather.

Australian Sandarach.—Australian Sandarach burns readily, and on the Snowy River (near the Victorian border) it is often mixed with fat by the settlers to make candles. The aborigines used frequently to use it for a similar purpose. Sir Thomas Mitchell (*Three Expeditions*, ii, 37) says: "Each carried a burning torch of the resinous bark of the *Callitris*, with the blaze of which these natives (Lachlan) seemed to keep their dripping bodies warm.

The *Callitris* resins soften slightly, but do not melt in boiling water, and a sample of commercial Sandarach behaves similarly. In the mouth they feel gritty to the teeth, and in no way different to Sandarach. When freshly exuded they are very irritating to a cut.

I will reiterate, at this place, in order to save time, that the properties of Sandarach are shared by Australian Sandarach; I do not know in what respect they differ, and the one article may be substituted for the other.

It was a specimen of resin from the Oyster Bay Pine of Tasmania, sent to the Exhibition of 1851, which first drew the attention of experts to the possibilities of Australian Sandarach. For "the fine pale resin of the Oyster Bay Pine (*Callitris australis*) from the eastern coast of Van Diemen's Land" and other gums and resins, Mr. J. Milligan was awarded honorable mention (*Jury Reports*, 1851 *Exhibition*, p. 182).

I have only alluded to naturally growing trees, but Baron von Mueller states, "Probably it would be more profitable to devote sandy desert land,

which could not be brought under irrigation, to the culture of the Sandarach Cypresses than to pastoral purposes, but boring beetles must be kept off." Of course Cypress Pine timber is very valuable, as it is ornamental, and one of the best of our timbers to resist white ants, but I propose to confine myself to the resin in this paper.

The various kinds of Cypress Pines.—Our Cypress Pines all belong to the natural order Coniferæ (Cone-bearers), and are therefore allied to the Pines, Firs, Spruces, &c., of the Northern Hemisphere. They belong to the genus *Callitris*, which is mainly a synonym of *Frenela*. [The word *Callitris* is from the Greek *Kallos*, beautiful, in allusion to the appearance of the trees. *Frenela* is in honor of M. Frenel, a former member of the French Academy.]

In the Australian Colonies there are twelve species of *Callitris*, and some of them have varieties more or less marked, so that there are a goodly number of Australian Cypress Pines. Four of the species (*Roei*, *Drummondii*, *Actinostrobus* and *acuminata*), are confined to Western Australia, and have, of course, but a limited interest to us in the eastern colonies. *C. oblonga* is only found in Tasmania.

The Cypress Pines that are found in New South Wales, and which therefore especially interest us, are seven, namely:—

1. *Callitris Macleayana.* "Port Macquarie Pine," an elegant species now often seen in gardens.

2. *C. Parlalorei.* "Mountain Cypress Pine." "Stringybark Pine." These two species are closely allied, and are both found in the North Coast districts. They are not as abundant nor do they yield Sandarach as freely as the other species.

3. *C. verrucosa.* The "White or Common Pine;" often known simply as "Pine" or "Cypress Pine," but also as "Mallee Pine," "Rock Pine," &c. Well known under its name of "Murray Pine." It is the most widely diffused of all the Cypress Pines, being found in every one of the mainland colonies. It is easily known by its rather ornamental warted cones.

4. *C. columellaris.* This is usually known as "Cypress Pine," and it attains a great size. It appears to be confined to the coast districts and moderate elevations of Northern New South Wales and Southern Queensland.

5. *C. Muelleri.*—"Baron Mueller's Cypress Pine," "Mountain Pine." This species is often very ornamental. Its range does not appear, at present, to be very well defined. I have collected it at Middle Harbour, Port Jackson, and in the Blue Mountains (Mount Victoria). It has been sent to me from the Illawarra. Mr. Baker has collected it at Rylstone in the Mudgee district.

6. *C. cupressiformis.*—Perhaps better known by its synonym of *rhomboidea*. This pine I believe to have been a good deal confused (in New South Wales) with the preceding. Of course the cones are quite different. It is usually simply known as "Pine" or "Cypress Pine." It is extensively diffused in the coastal districts.

7. *C. calcarata.*—Better known under its synonym of *Frenela Endlicheri*. Everybody knows it under its name of "Red or Black Pine," whose timber is so largely used in the western parts of the Colony where white ants are prevalent. I need not further allude to the species here.

Of the above, *C. verrucosa* and *C. calcarata* will be found by far the most important from a commercial point of view, but the others all produce excellent sandarach.

Experiments on some Australian Sandarach of varying quality from various species.

Having learnt what sandarach is, and what Australian trees produce it, the following notes of observations and of incomplete experiments on definite Australian sandarachs will be interesting. To push the experiments further than I have done, would be more of scientific than of economic interest.

My experiments tend to show this:—Given similar circumstances in regard to size and age of tree, season of flow, climatic conditions, &c., the sandarachs from all the species are precisely similar in chemical and physical properties. Conversely it follows, that if two specimens of sandarach are of different qualities, the explanation is to be found in the circumstances above enumerated. What is the best season to collect sandarach or to bleed trees in a particular district, is only to be learnt by experience, and I think I have said enough to show that it is worth the trouble to try and find out.

Callitris verrucosa, R. Br. (Syn. *Frenela robusta*, A. Cunn).—A sample of "Murray Pine" resin from Quiedong, near Bombala, has a pale bleached appearance, much lighter than ordinary sandarach. Externally it has a very mealy appearance. Water has no effect on it. In rectified spirit, it almost wholly dissolves, leaving a little whitish resinoid substance. Petroleum spirit dissolves 5 per cent. of a perfect colourless and transparent resin.

Speaking of "Mountain Cypress Pine" or "Desert Pine" (*C. verrucosa*), the Catalogue of Victorian Exhibits, Colonial and Indian Exhibition, 1886, states, "A sandarach in larger tears than ordinary sandarach is yielded by this species. It yields it in considerable abundance, 8 or 10 oz. being frequently found at the foot of a single tree, but although this exudes naturally, the supply is stimulated by incisions."

"It is a transparent, colourless, or pale yellow body, fragrant and friable, fusing at a moderate temperature, and burning with a large smoky flame; very soluable in alcohol and the essential oils, and almost totally so in ether; turpentine at the ordinary temperature does not act upon it, nor do the drying oils, but it may be made to combine with these solvents by previous fusion." (*Report on Indigenous Vegetable Substance, Victorian Exhibition*, 1861).

This resin was used to make firm the union (after lashing) of the hard-wood head to the reed in the making of reed-spears by the aborigines of Victoria. The resin was called by them Bij-jin-ne. (Brough Smyth, *Aborigines of Victoria*, i. 306).

A sample of New South Wales resin of this species is of a dark amber colour, and, externally, possesses the dulled appearance found on lumps of amber. It is the darkest specimen of an Australian Sandarach hitherto examined by me. It almost wholly dissolves in rectified spirit, yielding a bright yellow liquid: leaving 2·5 per cent. of insoluble residue. Petroleum spirit removes 22·8 per cent. of a clear resin when the original substance is digested in it.

Callitris verrucosa, R. Br. (Syn.: *C. Preissii*, Miq. partly).—The following note by Dr. Julius Morel (*Pharm. Journ.* [3], viii, 1025) in regard to a specimen of South Australian resin, is interesting. "With Sandarach resin may be connected another resinous substance, which was exhibited in the Paris Exhibition of 1867 from South Australia under the name of "Pine Gum." It is the resin of *Callitris Preissii*, Miq. The product resembles Sandarach, and might become an important article of commerce. . . . This resinous substance occurs in the form of slightly yellowish tears, thicker and

longer than those of ordinary Sandarach. In consequence of unequal contraction it presents, like Sandarach, numerous facets: and, consequently, the surface appears to be covered with a white powder. In its transparency and hardness the resin corresponds to Sandarach. Its odour is very agreeable and balsamic, and the taste is bitter and balsamic."

Callitris columellaris, F. v. M. (Syn.: *Frenela robusta*, A. Cunn: var. *microcarpa*, Benth.).—A sample of resin from this species dissolves almost entirely in rectified spirit, forming a pale yellow solution. The insoluble residue amounts to 4·6 per cent. Petroleum spirit, when digested on the resin, removes no less than 35·8 per cent. of a transparent, colourless resin. This is a remarkable percentage, and it would be interesting to enquire whether Australian Sandarach becomes increasingly soluble in that menstruum by age. An ordinary sample of commercial Sandarach yielded 8·9 per cent. to petroleum spirit.

Callitris cupressiformis, Vent.: "The Oyster Bay Pine of Tasmania," partly.—This is the pine already referred to, and a brief account of the resin has been copied into many of the text-books. I have collected resin of this species from Port Jackson, clear and transparent as water. It turns pale amber coloured if placed in a bottle, but its brilliancy shows no sign of diminution in that time. The Sydney trees readily exude their resin on slightly wounding, and the same remarks apply to the Tasmanian.

Callitris calcarata, R. Br. (Syn.: *Frenela Endlicheri*, Parlat).—A sample of Red Pine resin from the Lachlan River has freshly exuded, and has the colour and appearance of best selected Sandarach. Rectified spirit nearly wholly dissolves it, forming a beautifully clear slightly-yellowish liquid, with 1·3 per cent. of residue. Petroleum spirit extracts 22·1 per cent. of an apparently perfectly colourless and transparent resin.

APPENDIX A.

Gum Sandarach.

London, 11th May, 1892.—The market is very dull. At auction sale last Thursday a few packages sold, without reserve, at 59s. 6d. to 61s. for fair palish gum.

London, 16th September, 1893.—Sold cheaply to-day at a decline of about 3s. to 4s. for a parcel of 13 casks, offered without reserve; it brought from 72s. to 74s. per cwt.

London, 14th Oct., 1893.—A parcel of 12 casks sold cheaply, without reserve, at 65s. per cwt.; one lot realising 1s. more.

London, 25th Nov., 1893.—Nineteen casks sold very cheaply to-day; ordinary dirty and dusty at 48s. 6d., medium quality at from 64s., rising to 69s. per cwt.

London, 3rd March, 1894.—Seven casks, mostly oil damaged, sold, without reserve, with fair competition, at 41s. to 56s. per cwt.

The latest London quotation of a wholesale London firm is 125s. per cwt

Botanical Notes.

Fruit of Cryptocarya Meissneri (F. v. M.)

The fruit of this tree was hitherto unknown to science until Mr. Forester Brown, of Port Macquarie, recently sent it to the Department. The fruits (or fruiting perianths) are ovoid, usually pointed at both ends, and up to threequarters of an inch long.

New Locality for Cryptocarya Patentinervis (F. v M.)

This small tree, only known from the Hastings to the Tweed Rivers, has been sent from as far south as the Upper Williams River, county of Gloucester. Mr. Forester Rudder, who sent it, describes his plant as 30 feet high, and with a trunk 3 inches in diameter.

New Locality for Prostanthera Empetrifolia (R. Br.)

Mr. Augustus Rudder has also sent to the Department a specimen of *Prostanthera empetrifolia*, from Booral. The leaves of his specimen are mostly an inch long, the usual length being about half-an-inch, but the find is chiefly interesting from the fact that the plant was not previously recorded from the northern districts. It was hitherto known from Port Jackson and the Blue Mountains. We have a great deal to learn yet of the range of our native plants.

An Indigenous Plant (*Hydrocotyle asiatica*, Linn.) possessing Medicinal Properties.

Hydrocotyle asiatica is a creeping plant with roundish or kidney shaped, bright green leaves, and inconspicuous flowers. One at least of its congeners (*H. laxiflora*), has an abominable fæcal smell, and is ironically known as "Native Mignonette." *H. asiatica* is found in moist places in many parts of the Colony. In the coast districts, and particularly near the northern rivers and table-lands where there is rich soil, it grows in the greatest profusion, covering the ground for large areas with a carpet of bright green. It is also found in New Zealand, the Pacific Islands, and tropical and sub-tropical Asia, Africa, and America. It belongs to the natural order *Umbelliferæ*.

Mr. G. M. M'Keown, Manager of the Experimental Farm at Wollongbar, Richmond River, recently sent this plant to the Department, stating that it is "credited locally as valuable when applied to wounds or sores in the form of a salve or poultice."

This is the first occasion on which I have heard of it being put to use in New South Wales, but it is a well-known remedy in India, having been in use amongst the natives for many centuries. It is officinal in the Pharmacopœia of India (Waring, 1868, p. 107). From that work the following particulars are obtained:—

Official part.—The leaves. In the fresh state they have little or no smell, but when bruised they exhale a peculiar aromatic odour; taste pungent, bitter and disagreeable.

Active principle.—A pale-coloured, pungent, bitter volatile oil, named *vellarine.* The dried leaves are not distinguished by any remarkable odour or taste.

Properties.—Alterative tonic; locally applied, stimulant.

Therapeutic uses.—In anæsthetic leprosy good results have followed its use, but it possesses no claim to the character of a specific attributed to it by some. It has been found more useful in secondary or constitutional syphilis, especially in those cases where the skin and subjacent cellular tissue are principally affected. In non-specific ulcerations, and in skin diseases, it is of value both as an internal and as a local remedy.

Preparations.—Powder of Hydrocotyle. Take of freshly gathered hydrocotyle leaves a sufficiency; remove the stalks, and dry thoroughly by exposure to the open air in the shade at a moderate temperature; when thoroughly dry, reduce to fine powder, and transfer to well stoppered bottles. [Thirty pounds of the fresh leaves prepared in this manner, yield between 3 lb. and 4 lb. of the powder, which is of a pale-green colour, and slight but pleasant aroma. Solar and a high artificial heat are objectionable, as they cause the dissipation of the volatile oil, on which the activity of the leaves depends].

Dose.—From 5 to 8 grains daily. Sprinkled on alcerated surfaces, it stimulates them to healthy action.

Hydrocotyle Poultice.—Take of fresh leaves of hydrocotyle a sufficiency; bruise and moisten with cold water.
A valuable stimulant application to various forms of ulceration.

The Pharmacographia indica, ii, 107 (1891), confirms the above estimate of the therapeutic value of the drug, and also states that it is so abundant in the Mauritius that it serves as forage for cattle, whose milk it improves; it is also greedily eaten by pigs and other domestic animals. It is the more desirable to draw attention to an indigenous medicinal plant, as we have so few that, in the present state of our knowledge, possess undoubtedly valuable properties. In the bush it will be most convenient to employ the plant in the manner and for the uses indicated in Mr. M'Keown's note.

The Barnyard Grass (*Panicum crus-galli*, Linn.).

Within the last few months this one grass has been perhaps as frequently sent to the Department as all other grasses put together. It has been sent from Goulburn, Kanimbla Valley, Carcoar, Forbes, Dripstone (somewhere out west, but I don't know exactly where), Parkes, Armidale, Albury, and other localities of which I have kept no record.

It may also be found in almost every suburb of Sydney, usually at the edges of roads which have not been kerbed and guttered, generally in damp places, and sometimes actually growing in water. It often appears in freshly broken up land, rubbish heaps, &c.

Although a recent introduction into many of the localities in which it is now found, it is a real Australian native, although it is also found in many parts of the world.

So that it is by no means confined to the coast districts. What is the explanation of its appearance in so many places during the same season can perhaps only be guessed at, and it really does not very much matter. It may have been distributed in seed sent by a Sydney house.

All who express any opinion in regard to it are loud in its praises as a nutritious grass, which produces an enormous quantity of feed. It seeds sometimes at a foot high, but usually it is a much larger plant, attaining a height of 6 feet and even more. A figure of the grass will be found in the *Gazette* for April, 1891.

The late Dr. George Vasey, in "The Agricultural Grasses of the United States," says of the Barnyard Grass:—"In the northern states it is esteemed as a rough coarse weed; in the south it is often utilised and considered a very useful grass." He quotes Dr. Charles Mohe, of Mobile, Alabama, who says:—"It grows luxuriantly, particularly in the lowlands of the coast, is greedily eaten by horses and cattle, and makes a hay of good quality. It is justly regarded as an excellent grass, particularly before it ripens its seed, as in the latter stages of its growth the long and stiff awns of its spikes tend to make it somewhat unpalatable." He also quotes Professor Phares, of Mississippi, who says:—"In Louisiana, Mississippi, and some other states it is mowed annually. Some farmers assure me that they harvest four or five tons of hay per acre. It may be cut twice each season by making the first mowing as soon as it begins to bloom. I know no one who plants it; but it annually re-seeds the ground and requires no cultivation or other care, save protection from live stock and the labour of harvesting. Being a coarse grass, with long leaves and large succulent stems, it requires care to make into hay. In one county in Mississippi, hundreds of acres are annually mowed on single farms. Cows and horses are very fond of it whether green or dry. Farmers who have tested it most thoroughly for many years prefer it to the best corn fodder."

Here is a Canadian opinion of it. "A tall coarse grass producing a great quantity of succulent feed, which is highly relished by stock. It grows in low land and around dwellings throughout the country. In the early stages of growth it is excellent and nutritious feed; but as it reaches maturity, in common with most grasses, deteriorates rapidly, indeed somewhat more rapidly than any other." (Fletcher, *Bulletin* No. 19, *Central Experimental Farm, Ottawa.*)

Mr. Fletcher also gives an analysis of a Canadian specimen of this grass. The sample selected was in flower. Following is its percentage composition:—

	In fresh or green substance.	Calculated to water free substance.
Water	85·30	....
Ash	1·64	11·16
Protein (albuminoids)	2·02	13·75
Fibre	4·48	31·09
Nitrogen free extract (carbo-hydrates)	6·25	41·87
Ether extract (fat)	·31	2·13
	100·00	100·00

It will be interesting to compare these analyses with those of three samples of grass of American growth, as quoted in Dr. Vasey's work.

	In fresh or green substance.			Calculated to water free substance.		
	1.	2.	3.	1.	2.	3.
Water*	14·30	14·30	14·30	......	......	......
Ash	5·98	13·37	10·13	6·98	16·07	11·82
Albuminoids	6·66	3·42	10·80	7·77	3·99	12·60
Fibre	24·78	26·68	21·69	28·91	31·13	25·32
Nitrogen free extract	46·44	40·08	40·95	54·19	46·77	47·77
Fat	1·84	1·75	2·13	2·15	2·04	2·49
	100·00	100·00	100·00	100·00	100·00	100·00

* These samples were, of course, very much drier than the Canadian sample.

The percentages of total nitrogen, or non-albuminoids, and of nitrogen as non-albuminoid substances, are also given, and at page 139 an analysis by Wolff of the ash of this grass is given, but it will be sufficient to quote where they are to be found. The other analyses quoted by Dr. Vasey are by Clifford Richardson.

Speaking generally, it may therefore be said that the grass arrives at its greatest perfection in moist warm localties; in colder climes it gives less satisfaction. I have shown that it will grow in many parts of our Colony, and I would recommend farmers to give every encouragement to it for horse and cattle feed. It is too coarse for sheep. An advantage of it is the freedom with which it seeds.

Apple Culture.

By ALBERT H. BENSON,
Fruit Expert.

CHAPTER I.

Origin of the Apple.

All the numerous cultivated varieties of the apple have been originally derived by cross-fertilization and natural selection from the Wild Crab of Europe—the *Pyrus Malus* of Linnæus—which is found growing wild over all the temperate regions of Europe and Western Asia, and is probably indigenous in England. We have no definite knowledge when the first improvement from the wild state occurred, but that the fruit is of very great antiquity we have every reason to believe, as it is mentioned by Homer, and is several times referred to by Roman writers. Many varieties were known to the Romans, and the fruit was held in high esteem by them. Besides the Wild Crab of Europe, several other species of Wild Crabs are known, of which one at least—the Siberian Crab (*Prunus prunifolia*)—has been introduced into our orchards; but they are of no importance when compared with the *Pyrus Malus*. The apple is undoubtedly the king of all the fruits of the temperate regions, and is more widely distributed and more universally used than any other cultivated fruit.

Uses of the Apple.

Unlike most other fruits, the apple is looked upon more as a necessary article of everyday use than as a mere fruit, and this is mainly on account of the many and varied uses to which it may be put. It is either used fresh for dessert, or it may be cooked in many different ways. It may also be dried and packed so that it will keep for years without deterioration, and may be sent to any part of the world. It makes an excellent jelly; in fact, a large proportion of the fruit jellies of commerce consist mainly of apple jelly flavoured and coloured with the fruit it is wished to represent. In the United States a common, excellent, and wholesome article of food, termed apple butter, is made by stewing pared and sliced sweet apples in new cider.

The expressed and fermented juice of the apple forms cider, and from sour cider a very good and wholesome vinegar can be made. Apples also enter largely into the manufacture of many sauces and chutneys, and when cooked, or if thoroughly ripened and used fresh, they are a wholesome and

nutritious article of food, as will be seen by reference to the following analysis of the whole fruit by the late Professor Church:—

Water	83·00
Albumen	0·40
Sugar	6·80
Malic acid	1·00
Pectose, pictin, and gum	5·20
Cellulose	3·20
Ash	0·40
Total	100·00

The quality of the apple determines its use. Thus apples for dessert should be of medium size and possess high flavour and quality; for cooking, however, a large, well-flavoured sub-acid fruit of medium texture is preferred, and in this Colony it is also necessary that a good cooking-apple, to be readily saleable, must have a green or greenish-yellow skin—though this is due to the ignorance of the buyers in not knowing the requirements that it is necessary for an apple to possess in order to render it a good cooker. The colour of the skin has nothing whatever to do with the quality of the fruit, some of the very best cooking varieties being of a very high colour, and the finest dessert apple in the world, the Green Newtown Pippin, as grown in the north-eastern States of America, is, as its name implies, a green apple. For cider, a soft-fleshed, juicy apple, having a sweet or somewhat acid, rough or bitter-sweet, though dense, juice is required.

For apple butter, a soft, sweet apple is best; and for drying, a large apple, having a firm, white flesh that will cook well, is preferable.

Districts for the Apple.

There is no part of New South Wales where the cultivation of the apple is not possible, though in some districts it is never likely to become profitable. If care is exercised in the selection of varieties, apples can be grown in the almost tropical northern rivers district, and also in the hottest and driest parts of the interior with proper care, the selection of suitable varieties, and the judicious use of water for irrigating; but it is mainly to the colder parts of the Colony—the different elevated table-lands—that we must look when we want to produce the best fruit.

The apple is essentially a fruit of the temperate regions, and in order to produce fruit of the finest quality it is necessary for the trees to undergo a winter rest in as nearly a dormant condition as possible, and it is this failure to obtain the necessary rest that renders the warmer coast districts of the Colony unsuitable for growing the finer varieties of long-keeping apples, or of producing an apple equal in flavour and texture and having as good keeping qualities as the same variety grown in a district where the tree undergoes a good rest, even though during the summer the temperature may be higher than that experienced in the coastal and more humid districts. The coastal districts, except the most northern, are however, well adapted for growing early and mid-season varieties, both for dessert and cooking, for local consumption, as the fruit is disposed of, in a great measure, before the fruit of the colder districts is ready for market, thus the two districts do not clash. The apple thrives remarkably in the coast districts, the tree-growth being very rapid, and the trees bearing early and heavily. This is essentially the case with apples of local origin, which are thoroughly adapted to local conditions, but many apples of foreign extraction do very well, and have become perfectly naturalised.

It is a very difficult matter to say where the best apples are grown in this Colony, as the districts that produce really good apples are numerous and widely separated from each other, and they are also very dissimilar in the character and quality of their soil; and again, certain districts produce certain kinds of apples to greater perfection than others. I have, however, received apples equal to anything produced either in the old or new world from the following districts:—New England, Orange, Molong, Bathurst, Goulburn, Breadalbane, Crookwell, Monaro, Yass, Moss Vale, Tumberumba, several parts of the Blue Mountains, and some splendid fruit from other and warmer districts, such as Tumut, Inverell, Albury, Deniliquin, Wagga Wagga, Narrandera, Bega, and from several parts of the counties of Cumberland, Camden, and Northumberland, so that it is easily seen that the profitable range of the apple is a very wide one in this Colony, and yet, instead of producing enough to supply our own wants, we are largely dependent on Tasmania for our supply of late-keeping varieties.

Soils for the Apple.

Although the apple will grow in almost any kind of soil, provided it possesses sufficient natural drainage, the best soil for the apple is a soft sandy loam of good depth, having a subsoil of clay, marl, loam, shale, or rock, but not gravel, and possessing good natural drainage, stagnant water round the roots of the trees rapidly proving fatal. The apple does not require too rich a soil, if quality and keeping properties are a consideration, and it will often thrive and produce heavy crops of good fruit on soils that are too poor to produce any other fruit to perfection, or to grow any farm crop profitably. No fruit makes a smaller call on the soil than the apple, as will be seen by reference to the following analysis of the ash of the fruit and of the tree, which I have obtained from Professor Wickson's work on "Californian Fruits, and how to grow them":—

	Apple Fruit.	Apple-tree.
Potash	35·68	19·24
Soda	26·09	0·45
Magnesia	8·75	7·46
Lime	4·08	63·60
Iron	1·40	0·07
Phosphoric acid ...	13·59	4·90
Sulphuric acid	6·09	3·29
Silicic acid	4·32	2·06

The total amount of ash in 1,000 lb. of fruit is 2·2 lb., and contains:—

Potash (K_2 o), ·80 lb.
Phosphoric acid ($P_2 O_5$), ·30 lb.
Nitrogen (N), ·60 lb.

In a crop of 20,000 lb. the following are the amounts of each of these substances extracted from the soil, which must be replaced by manuring if the soil requires it:—

$K_2 O$ — 16 lb., supplied by 32 lb. of sulphate of potash, containing 50 per cent. of K_2 o.

$P_2 O_5$ — 6 lb., supplied by 33 lb. of superphosphate, containing 18 per cent. of $P_2 O_5$.

N — 12 lb., supplied by 60 lb. of sulphate of ammonia, containing 20 per cent. of N.

Propagation of the Apple.

The apple is easily propagated, either from seed, by budding or grafting the desired variety on to a suitable stock, or by means of cuttings or layers, though the latter methods are seldom resorted to. Propagation from the seed is entirely chance work, and is a very uncertain method of obtaining varieties true to the parent stock, on account of the prevalence of cross-fertilization; but it is by means of the seeds of apples that have been purposely or accidentally crossed that we obtain new varieties. The methods of propagation most commonly employed are root-grafting and budding, and these methods I will now describe in detail under the heading of

Stocks.

There are several stocks for the apple:—

1st. *The Seedling Apple Stock.*—This stock is used almost universally in England when standard trees are required. The seeds chosen are of strong and rapid growing varieties, and the stocks, when large enough, are worked over either by budding or grafting into the varieties that it is desired to propagate. The seedling stock, although it is a strong-growing stock, and makes the finest root system, is, however, not much used in this Colony on account of its tendency to blight (woolly aphis), but, occasionally, the seeds of blight-resistant varieties are planted for stocks, and answer very well.

2nd. *The Wild Crab Stock.*—This stock is not used in this Colony, and may, therefore, be left out of the question.

3rd. *Dwarfing Stocks.*—Two stocks are used for dwarfing—the English Paradise or Doucin, and the true or French Paradise, the latter being the better stock. Both these stocks are very susceptible to the attack of the woolly aphis, and, in consequence, they should never by any chance be placed below the surface of the ground, as they throw out roots readily, and these roots will very quickly become infested with blight. Dwarfing stocks should always be used in conjunction with blight-resistant stocks—never alone.

4th. *Blight-resistant Stocks.*—By blight-resistant stocks I mean a stock the roots of which are not attacked, or only slightly attacked, by the woolly aphis, so that when fighting this great pest the orchardist need not have to trouble about the roots of his trees, but can confine his attention to the parts of the tree aboveground. By experience it has been found that certain varieties of apples are very little affected by the woolly aphis under any conditions, and advantage has been taken of this knowledge to use these varieties for stocks, so as to minimise as far as possible the evil effects of the disease. Of these blight-resistant varieties two are commonly used for stocks—one, the Northern Spy, an American apple of a strong very upright habit of growth, and having a very fibrous root; the other, the Winter Majetin, a vigorous but more spreading tree, having long spreading roots. The Northern Spy root is often unsuitable for light sandy soils, being too fibrous, and not having a sufficiently firm hold of the ground, so that the trees are apt to be blown down by a heavy wind. In such soils the Winter Majetin root is preferable.

The usual method of propagating blight-proof stocks is as follows:—A small piece of the root of a blight-resistant apple, from three to four inches long and of the thickness of a lead pencil or larger, is obtained, and on to this root a graft of a blight-resistant apple is worked. The root and graft should

be of as nearly the same size as possible, or the root if anything larger than the graft when the method employed is that of the root-splice graft.

When, however, the graft is larger than the root, or when there

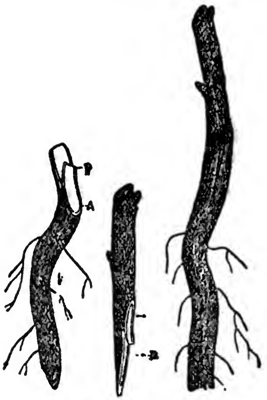


Fig. 1.—1. The root, showing sloping cut at *A*, and the tongue at *B*. 2. The scion, showing sloping cut at *A*, and the tongue at *B*. 3. The union of scion and stock ready for waxing.

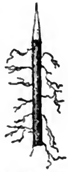


Fig. 2.—The Root.

Fig. 3.—The Scion

Fig. 4.—Scion, with Root in position.

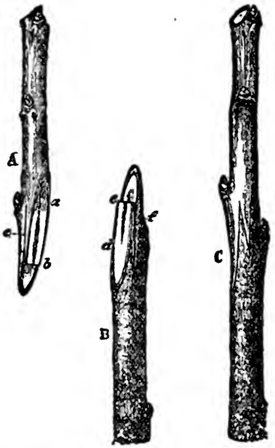


Fig. 5.—*A*. The scion. *a*. The sloping cut. *b*. The tongue. *c*. Shows thickness of tongue. *B*. The stock. *d*. The sloping cut in the stock. *e*. The tongue. *f*. Shows thickness of stock from the cut or tongue. *C*. The scion inserted, and ready for waxing.

are a number of small roots available, then the method employed is that of the root-side graft, or root help as it may be termed.

Whichever of these methods is employed the grafts are carefully tied with rafia or other tying material, but not waxed, and are then planted out in the nursery row, where they are carefully attended to, only one bud of the graft being allowed to develop. The following winter or early spring they are worked over into the variety that it is desired to

propagate by means of grafting—this time by the ordinary splice or whip-graft, the graft being firmly tied and waxed. You have thus a doubly worked tree, of which the roots and lower part of the trunk are blight-resistant, and only the top is liable to blight. When it is desired to dwarf the trees, the Paradise stock is used, and in this case the stocks are first worked as described, but instead of working the desired variety direct on to the blight-resistant stock, a paradise graft is first worked on, and the year following the variety that it is wished to propagate is worked on to the paradise wood. You have thus a tree that has been worked three times—first, blight-resistant wood is worked on to a blight-resistant root; second, paradise wood is worked on to the blight-resistant wood; and, thirdly, the desired variety is worked on to the paradise. Budding may be employed in all cases in the place of grafting if desired, except in that of the first working—the blight-resistant wood on to blight-resistant root, when grafting only can be done. Full particulars of all the different methods of grafting as applicable to different sized stocks will be found by referring to the article on grafting which appeared in the September number of the *Gazette* for 1892.

Other stocks in addition to those mentioned have been used for the apple, but they are not of sufficient importance to take note of, and should never be used, for though the trees may grow, they will never thrive equally as well as those on the stocks that I have described.

Selection of Site.

In order to obtain the best results from the apple orchard it will always pay to select the most suitable situation that is obtainable, for though the apple will grow almost anywhere, yet under certain conditions it will do much better than under others not so favourable—generally speaking, a gentle slope to the north. North-east or north is to be preferred. Too steep a slope is not desirable, as the ground is apt to wash badly with heavy falls of rain, especially if it is kept in the high state of cultivation that is so necessary for successful culture—especially in the warmer and drier districts of the Colony. The general lie of the surrounding country should always be taken into consideration when selecting the site, and every advantage taken of the natural shelter that may exist. Cold, frosty hollows should always be avoided, owing to the possibility of injury to the blossoms from frost in such places. Open plain country, subject to heavy wind-storms, should also be avoided, but if no other site is available, then, before planting, the site should be surrounded with a good artificial shelter. Sound, well-drained land, not too rich, should also be chosen, and if the land is deficient in drainage then this want must be artificially supplied, as no matter how suitable the soil, climate, or situation, if there is not a perfect drainage the apple will not thrive. The trees may do very well for the first few years, but as soon as the roots penetrate down to the stagnant water the tree will show signs of failing and probably become diseased. Stagnant water round the roots sours the soil, scalds the fine fibrous roots, and tends to set up a generally unhealthy action of the tree's growth, which is the immediate cause of many of the diseases that affect the apple.

Drainage.

In my article on Orange Culture in the *Gazette*, September, 1893, I mentioned the best methods of drainage, and laid stress on the great necessity for carefully attending to this most important and often sadly neglected

operation, and I cannot do better than quote what I then stated as to the advantages to be derived from a good system of sub-drainage.

1st. The removal of stagnant water from around the roots of the trees, and a general sweetening and warming of the soil.

2nd. A thorough aëration of the soil, which causes the process of the disintegration or breaking up of the soil to take place more rapidly, thus rendering many of the inorganic constituents of the soil more readily available as plant food.

3rd. Increased facilities for working the land which is much kinder and more friable than undrained land, as after heavy rain one is enabled to get on heavy land much sooner when drained than when undrained, which is of itself a very great consideration in the matter of keeping down weeds in seasons such as we are having.

4th. Increased facilities for the absorption of moisture by the soil, and thus rendering it better able to withstand drought than an undrained soil, having a smaller capacity for absorption.

Space will not permit my entering fully into the different methods of sub-drainage in this article, but I cannot let the opportunity pass without giving a few words of advice, and these are:—Do whatever drainage has to be done thoroughly, and do not put the drains too far apart or too deep; in sticky retentive soils 20 feet apart and 30 inches deep is enough, as in such soils the drains will not draw further, but rather do a small acreage thoroughly than a large one indifferently, it will pay better and give far greater satisfaction in the long run. Personally I am in favour of tile drains, as they last longer, do better work, never choke if properly laid, and the expense of digging the drains and laying the tiles is much less than in the case of stone, slab, or sapling drains. The only advantage in these drains is that in most cases the material is at hand and costs nothing except the labour, but if this has to be hired it will be cheaper and more satisfactory to drain with tiles. In draining with tiles it is false economy to use too small tiles—2 inches in diameter is the smallest that should be used under any circumstances, and only then when there is a short run and a good fall. Two and a half inch or 3-inch tiles are the best sizes for all branch drains. Main drains should be of 4-inch or 6-inch or even larger size, according to the area of land to be drained—length of main drains and fall.

Shelter.

A good shelter is always of the greatest importance in every orchard, both as a protection from the wind-storms, which shake the fruit and break, split, and otherwise injure the trees, and also as a protection against the hot "northers" of the drier districts, which scald both the fruit and the foliage, and often cause a premature and unnatural ripening of the fruit. As previously mentioned, when selecting the site advantage should always be taken of any existing shelter, such as a belt of timber, the natural lie of the land, or a background of higher land to break the force of the prevailing winds, or the winds that are found by experience to do the most damage in the district. If there is no natural shelter or only a partial shelter, then it is necessary to provide an artificial one, and this is best done by planting a double or treble row of shelter trees on all sides from which injury may be expected. There are many trees suitable for this purpose, as it is not necessary that they should be evergreens, and, therefore, trees valuable for their fruits may be used, such as the olive, mulberry, walnut, chestnut,

locust beans, pecans, or loquat for the coast; and if evergreens are wished, then some of the varieties of the pine, such as the *Pinus insignis* or *Pinus pinaster*, or the olive may be used.

The whitethorn or hawthorn is often used for shelter hedges, but this is by no means desirable, as some of the worst diseases of the apple attack the whitethorn as well. This is notably the case with the *Mytilaspis pomorum*—the apple-bark louse or mussel-shell scale, with which many thorn hedges are badly affected. As this insect is one of the most troublesome ones to eradicate, and does a great deal of harm both to the tree and fruit, any plant that is likely to form a shelter and breeding ground for it should be carefully excluded from the neighbourhood of the apple orchard.

Preparation of the Land.

Do this thoroughly. Remember that planting an apple orchard is not like planting a field of wheat. The orchard has to last a lifetime, whereas the wheat crop only occupies the land for a few months.

Extra care in the preparation of the land will always pay in the end, as the trees will get a better start, thrive better, come into bearing earlier, and produce more and better fruit than where no attention is given to the matter. Never plant the trees on raw unsweetened land if it can be possibly avoided. Always get the land thoroughly sweetened, and into a good state of tilth first, then plant, and the trees will go right ahead. It is better to lose a season, and let the land either lie idle or take a hay or grain crop off it, than to rush the trees into the soil when it is in a totally unfit condition to grow them. The loss of time by waiting will be more than made up by the increased vigour of the trees. After the land has been cleared, and the roots taken out to a depth of not less than 18 inches, it should be ploughed as deeply as the soil will permit, but on no consideration should the subsoil be brought to the surface. The ploughing should be supplemented by subsoiling to as great a depth as the subsoiler can be got to work, especially if the subsoil is at all of a sticky, heavy, or retentive nature, as it will be found to be of the greatest advantage, by improving its mechanical condition, and facilitating drainage by allowing the otherwise stagnant water to get more readily to the drains. When, however, the soil is of a deep, sandy, loamy nature, easily worked, and possessing good natural drainage, then subsoiling is not so necessary; and if the land is deeply ploughed and left exposed to the weather in as rough a state as possible for a month or two, then after receiving a good harrowing, it will be in excellent condition for planting.

Laying out the Orchard.

As I have just stated, an apple orchard once planted is likely to stand a considerable time, therefore it will pay to take a little extra care to set it out in such a manner that it may be a credit both to the owner and to the district. There is no prettier sight than a well-planted and well-cared-for orchard, but a badly-planted and neglected orchard is an eyesore to any intelligent fruitgrower. In planting out the orchard the trees should be symmetrically arranged, and the rows, no matter from what angle they are looked at, should be faultless. Correct planting, besides adding to the appearance of the orchard, is of the greatest assistance in the working of the ground, as the work can be done much more easily and expeditiously than when the trees are planted anyhow. When the horse or horses used for cultivation have to dodge about to get from one side of the orchard to the

other, as is too often the case in some of our older orchards, instead of being planted the trees seem to have been broadcasted. I have already given full particulars in the *Gazette* (see article on Prune Culture) of how to lay out an orchard correctly, and will refer those needing instructions to it; but I may say that in setting out an orchard, if you do not commence with a true base-line, and do not set your first side-line at an absolutely correct right angle to the base-line, then you will never get your trees straight; for though you may get them true two ways, the diagonal lines will be anything but straight.

Do not plant your trees too close together; they require plenty of room to produce the best results. Planting in squares at 25 feet apart each way is the least distance at which standard apple-trees should ever be set in this Colony, and 30 feet apart is often better. Possibly in some of our rich alluvial soil 35 feet apart each way may be found to be none too wide, as when the trees are given plenty of room the roots are not cramped, and the tops grow in proportion to the roots.

When planting trees so wide apart, other quick-growing and early-bearing trees may be planted between the trees that will eventually occupy the whole of the ground; and when the ground is becoming crowded these early-bearing trees may be cut out, and the whole ground devoted to the permanently-planted trees. This is best managed by planting in one of the following manners:—

1st. *The quincunx.*—Here we have a square of four trees, at right angles and equidistant from each other, with a tree planted exactly in the centre, just where two lines drawn diagonally from the opposite corners of the square would intersect.

When the trees become too crowded, the fifth or centre tree in each square is removed. [See drawing.]

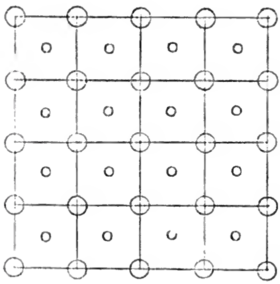


Fig. 6.—The Quincunx.

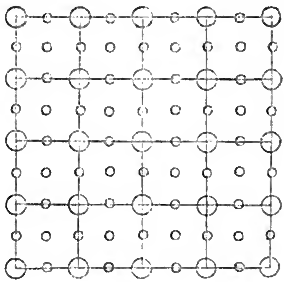


Fig. 7.—Alternating Squares.

2nd. *Alternating squares.*—Here we have the four permanent trees, forming the outer angles of four smaller squares; and when the ground becomes too crowded, all the trees excepting those that are to remain are removed. The manner in which this is done is easily seen by referring to the following drawing.

In planting dwarf trees the distance apart should not exceed 8 feet each way. But unless the orchardist is a skilled gardener I do not advocate the planting of dwarf trees, as the trees in this climate require constant care and attention, and a thorough knowledge of pruning, both root and top, to do well; but when they are in the hands of an expert, no trees will produce finer or higher-coloured fruit than a dwarf tree grown in the colder parts of the Colony.

What to Plant, and How to Plant.

As this article is intended to be more of a general guide for the ordinary fruitgrower and beginner than for the pomologist, I do not purpose going into the very vexed question of varieties at the present time, but will defer it to a series of articles at some future date, as it is far too comprehensive a matter to be treated in a general article—and will confine myself to a few general remarks. The first thing to bear in mind when planting out an orchard is not to plant too many varieties—the fewer varieties in season, provided that they are good ones and suited to the district, that are planted in an orchard the better it will pay. The planting of too many varieties, many of them of very doubtful value, is one of the greatest—if not the greatest—mistake our fruitgrowers have made in the past, and it has arisen from a desire to extend the selling season of each kind of fruit by means of a succession of different varieties over as long a period as possible. This has, no doubt, been of value in the past, but now, with the improved facilities for obtaining fruit from parts of the Colony other than the older fruit districts on which the market was then dependent,—it is necessary to grow only such fruits or kinds of fruit in each district as are best suited to the district, and can be produced to a greater perfection than in any other district. Thus, in the coast district we should only plant such varieties, whether for desert or cooking, that are in season before the later fruit of the colder districts is ready, and of the varieties that are suitable in this respect we should select none unless they show especial excellence in some respect; all others should be discarded. It costs just as much time, trouble, and expense to produce and market a case of inferior apples, that even at their best are a drug on the market, and hard to dispose of, as it does to produce and market a case of choice fruit which is readily saleable.

In the colder districts the apples grown should consist entirely of mid-season and late varieties, and only a few of the very best eating and cooking varieties, that are of proved excellence in the district, should be grown. Late keeping apples should be stored when grown, and there is no reason why we should not grow all that we require for our own consumption without having to depend on the imported Tasmanian article.

In choosing the trees from the nursery a yearling tree from 4 to 6 feet high without laterals is to be preferred; care being taken to see that it has a good root system, and that it has been worked on a blight resistant stock. Some growers prefer a two-year old tree, but in this case it should be carefully noted whether the tree has been properly headed back as a yearling. Before planting, the trees should be carefully examined, and all bruised or broken roots should be cut away, taking care to make the cut from the underside of the root, as young rootlets will then start from the cut surface.

Never set the trees too deep, the depth at which they were set in nursery is about the right depth to set them; more trees are ruined by too deep planting than by too shallow. In making the holes always see that the

centre is kept rather higher than the sides, so the drainage will tend to run from the base of the tree not towards it. The following drawings show a tree properly planted, and one improperly planted.

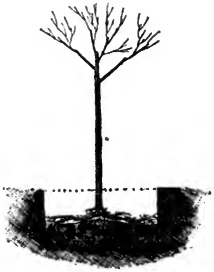


Fig. 8.

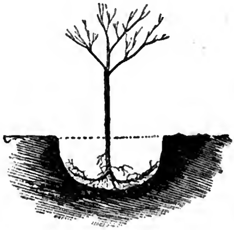


Fig. 9

In digging the holes the top soil should always be kept separate from the rest, and when the tree is set at the right depth, with the roots evenly distributed round the hole, then the fine top earth should be placed round the roots firmly and evenly, so that every root comes in direct contact with the earth and there are no hollow spaces. The hole is then filled up and the earth firmly placed, but not packed. No manure of any kind should be placed in the hole when the tree is planted.

Cutting Back at Planting.

If you want to get a strong symmetrical tree you must cut back at planting. The removal of the tree from the nursery has destroyed the greater portion of the fibrous roots of the tree, and in order for the top to correspond with the reduced roots it must be cut back. The cutting back at planting is the first and most important step in the formation of the future tree, and the grower who neglects to do it prevents, in a great measure, the future vigorous development that takes place when the tree is properly started. When a tree is planted out as received from the nursery without being cut back, there are a large number of buds on it, most of which will start, and the energies of the tree will be divided between them, the consequence being the production of a number of weakly and useless branches; but when the tree is properly headed back, and only three, four, or five buds are allowed to develop and form the future head of the tree, then all the energies of the tree are concentrated on these buds, and the result is the production of three, four, or five vigorous shoots just where they are wanted to form the future main branches on which the tree is built, no matter what system of pruning you may wish to adopt.

In the case of the apple the tree should be headed back at 18 inches to 2 feet high, taking care that the cut is made just above a strong bud. If the latter height is chosen, the buds that are to be left to form the future head should be allowed to start at 12 inches, 18 inches, and 24 inches respectively, and should be evenly balanced or distributed round the stem. Each limb will thus have a firm hold of the main trunk, and the tree will never split apart from the weight of the fruit. If it is found that no three

buds can be got that will form an even head, then four, or even five, must be left, but never more than five. Three limbs make a better tree than four, and four limbs make a better head than five.

Pruning.

For full particulars on pruning, I will refer to the article on this subject in the *Gazette*, and just give here what was then written as especially applicable in the case of the apple:—

"The manner of pruning described previously applies very well to the apple. It is best to plant yearling trees, and they may be headed back to from 15 to 24 inches, according to the idea of the grower. But, if headed at 24 inches, care should be taken to let the first branch come out at about 12 inches from the ground, and the other two, three, or four at regular intervals above it; as, as I previously explained, this makes a much stronger tree than if all the branches start from about the same spot. I have noted this objection in most of the apple-trees I have seen in the Colony, and also the fault of allowing too many main branches to start directly from the trunk. By doing so, one never gets as strong a tree as would have been obtained had it been pruned as I described. When apple-trees are of a close erect habit of growth, in pruning, always cut to an outer bud, as that will tend to spread the tree; and if the trees are of a naturally spreading habit, cut to an inner bud, which will tend to confine it and cause an upward growth. Even the most spreading tree, if properly pruned from the first, can be made to grow upright, and allow cultivation to be carried on right up to the trunk. The advantages of low heading apply to the apple as well as to other trees; and if the tree is started right, with a well-balanced head, and the branches well cut back to throw out strong laterals and strengthen themselves, and not allowed to crowd each other, you will have a tree come to bearing that will be strong and shapely, and that will carry its fruit within easy reach. Many apple-trees require little attention after they are once formed, but where branches several feet long are thrown out, they must always be shortened in; even a tree that has been started well would be spoilt if an excessive straggling growth were allowed to remain on. Care must be taken in warm districts not to prune apple-trees too much after they are shaped, for, as a rule, they require all the foliage they can grow to protect the tree and fruit from sunburn.

"The pinching of laterals, as previously recommended, is often of great value in the case of the apple, as the laterals are thereby converted into fruit-spurs, and the bulk of the crop of the tree is thus grown along the main limbs instead of towards the end of the branches, which is often the case with this fruit. Most apple-trees produce the greater portion of their fruit on two-year-old wood or on spurs, but in some cases most of the fruit is grown right at the end of the limbs, causing the tree to have a very straggling and untidy appearance, through the weight of the fruit bearing the limbs down."

Cultivation.

Keep the orchard clean—no orchardist can afford to grow a crop of weeds and a crop of fruit at the same time. If it is too much trouble to keep the orchard clean, then the best thing the owner can do is to quit growing fruit; he was not made for an orchardist, and should take up some easier line of work. Rest assured that if an orchard planted with the right varieties, in a suitable soil and district, does not pay when given thorough care and atten-

tion, and kept in the highest state of cultivation and free from all fungus pests—then a neglected, ill-pruned, ill-cultivated, and diseased orchard will stand a very poor chance, besides being a disgrace to the district and a propagating and disseminating ground for every kind of disease that fruit is subject to. Thorough cultivation is of the greatest importance to the orchard, as besides keeping the land clean and friable, it is the surest way of retaining moisture in the soil during a dry time. Where uncultivated land will dry right out and be perfectly unworkable, the same ground properly cultivated will retain all the moisture necessary for the trees' growth, and, what is more, should there be a shower at any time during the dry spell, the cultivated land will absorb and retain all the rain that falls, whereas the uncultivated land will absorb little, if any, the greater portion running off the surface and being lost. Every weed growing in an orchard in a dry time is robbing the trees of the water required for their proper development, so, therefore, if for no other reason, the orchard should be kept as clean as possible. Besides this, the growth of weeds and the accumulation of rubbish in an orchard forms the best of shelters for many injurious fruit pests, and renders it difficult to deal successfully with these pests.

Cultivating to retain moisture is best done by means of stirring the soil deeply, but not turning it over, so as to prevent the formation of the capillaries in the soil, thereby preventing in a great measure the loss of moisture by surface evaporation. By turning the land moisture is lost as the fresh surface exposed to the air rapidly dries out. The best implements for the summer cultivation of the orchard are the single and two horse cultivators, which are constructed for this especial purpose, and the disc and spading harrows. For winter work the plough is best, and any good American one or two horse plough with short stilts and having a short digging breast is suitable, and far preferable to the English style of plough. During the winter it is best to plough the orchard twice—once towards the trees and once from them—both ploughings the same way, not cross ploughing. If the land is of a heavy nature, then it is well to make the first ploughing towards the trees, turning the first few furrows next the trees shallow with a one-horse plough and finishing up with a two-horse plough, or, if a large orchard and gang ploughs are used, with a gang plough; in any case leaving the dead furrow midway between the rows of trees. The second ploughing the operation is reversed, the land being ploughed towards the centre, and the last furrow near the trees being ploughed out with a one-horse 8 or 9 inch plough, till all the ground is turned, and there is a small dead furrow at the line of trees. This can be easily managed if the trees are properly pruned, as described in my article on pruning, which I have previously alluded to, if the draft of the plough is blocked over so that the end of the short single-tree used does not come beyond the nose of the plough.

The beam of the plough and the handle that is next the trees can be wrapped up with sacks if wished, so that should the trees be struck by any chance there will be less likelihood of injuring them. The traces should also always be of leather, and the ends should be fastened to the back of the swingle-tree and pass over its ends, so if the swingle-tree should touch the trunk of the tree it will not do any great injury on account of the leather at the ends. By the use of a sideblock at the end of the plough-beam the horse can be kept out from the trees, and the plough worked right up to the trees as described.

By ploughing as described, instead of cross ploughing, the ground is kept level and even, and the soil does not tend to accumulate round the trees and bury the roots too deeply as is often the case where cross ploughing is

adopted. The next winter the ploughings should be done at right angles to that of the previous year, but both ploughings should be the same way—one towards and the other from the trees.

During the summer the ground should be kept constantly stirred, and the cultivator should always be used as soon after each rain as the land will work properly. If this is done a crust will be prevented from forming on the surface, and the moisture will be retained. All cultivation should be done, as far as possible, by means of horses—the work being performed cheaper, better, more thoroughly and expeditiously than it can possibly be by hand. Never do any work by hand that you can get a horse to do cheaper and better if you want to make fruitgrowing pay.

Manuring.

By referring to the analyses of the ash of the fruit and the ash of the wood of the apple previously given, it will be noted that the apple is by no means a gross feeder—the heaviest calls it makes on the soil being for lime for the wood, and potash and phosphates for the fruit—the total amount of manurial matter removed from the soil by a given weight of fruit being very much less than that of any other cultivated fruit, the quince excepted. Few soils, except the very poorest or a soil that is especially deficient in one of the essential plant foods, require much manure for apples; but if a manure is necessary, and this will be easily ascertained from the appearance and growth of the trees, if otherwise healthy, then it must be applied before the soil will produce a satisfactory return. Unless the soil is simply deficient in one of the essential plant foods—when the especial deficiency will have to be made good—the best manure to use is a general one containing all the elements of plant food, such as good farm-yard manure, but if this is not attainable, or it is not desirable to use it for fear of introducing weeds, such as sorrel, into the orchard, then boiling-down refuse, with the addition of a little kainit, makes a very good substitute, as its effects last a long time, as it only becomes slowly available for plant food. The best method of using boiling-down refuse is to form it into a compost with soil, or a mixture of soil, leaf-mould, or bush scrapings. The compost heap should be made by placing layers of the manure and soil alternately, and allowing it to remain for some months before using, taking care to keep it carefully covered from the rain. Previous to using, the compost heap should be turned over, and the whole thoroughly mixed. The best time to apply it would be during the late autumn or winter, so that the manure would be gradually becoming available for plant food, and be ready for the trees' use when the spring growth takes place. If the soil is deficient in lime, a manuring of a ton to the acre, applied in the autumn, will be required, but no other manure should be applied at the same time as the lime. Half a ton to the acre of boiling-down refuse composted into a ton and a half of compost, with 2 cwt. an acre of kainit added either to the compost, which is best, or applied by itself, should be sufficient for any soil, and such a dressing should last for three years, unless the trees are very large or the soil exceedingly poor, when the application will have to be made more frequently. The best way to apply the compost, if the trees are of any size, and the roots pretty well spread out, is to broadcast it over the whole ground, and cultivate or lightly plough it in. By the use of kainit all the magnesia required by the apple, which makes rather a heavy call on this substance, is supplied, as kainit contains, in addition to about $12\frac{1}{2}$ % of potash (K_2O) about 12 % of magnesia (MgO).

(To be continued.)

Drainage.

By G. R. McMINN, C.E.,
Minto.

Why, How, and When we should Drain.

Considering the number of persons who, from time to time, have taken up the occupation of cultivating the soil, it is remarkable how few have given serious attention to that really most important matter, the underdrainage of their land. During the last few years, many, for want of other outlet for their capital and energies, have, without much previous knowledge, gone extensively into orchard and vineyard culture; and it is those more particularly that I would address in this article, although the remarks will apply equally well to those engaged in raising cereal or root crops. In fact, I may say there is no class of cultivation that is not benefited by good drainage.

Numerous able and very explicit articles on the subject "How to Drain," have frequently appeared in the various public prints devoted to agricultural matters, containing information of great value to those who were already convinced of the value and great benefits to be derived from well-drained land; but I have rarely seen any articles on "Why we should Drain," and it will be my endeavour, in as clear and concise a form as possible, to try and impress those who have not given much attention to the matter, with the great importance of the subject.

I may say, that having had very considerable experience in carrying out some of the most extensive drainage schemes in Australia, including areas of some hundreds of miles in extent, and having seen the marked benefits following such work—transforming worthless swamps where, previously, only noxious reptiles and wild fowl found a home, into waving cornfields and prosperous homesteads—it may be allowed that I can speak with some authority upon the subject.

In the first place, I would say that I do not agree with some writers who hold that all lands want draining. Some are so naturally drained by having a subsoil of such a porous character that water sinks in them by gravitation quite readily enough. It would be just as easy to take the "breeks off a Highland man" as to take water from such land by means of artificial drains. Rather, what such land requires is for the surface to be kept in as fine a tilth as possible to prevent evaporation. But on the other hand, we have very large areas of clay land more or less heavy—land, in fact, that with only a moderate rainfall will, in a short space of time, become super-saturated with water which cannot escape in any other way than by evaporation or flowing over the surface, either of which is most objectionable.

In conversation with many cultivators, I have ascertained that they had an idea that because our climate was at times very dry, there was no great

need for drainage. Nothing could be more erroneous, for it has been found, by long experience, that for the proper disintegration of the soil so as to allow the plant-roots to penetrate to a depth to obtain a necessary supply of food and remain in a healthy condition, that an effective system of underdrainage is absolutely necessary; as also, by this means, to get rid of all superfluous water in as speedy a manner as possible. Underdrainage has the effect of making the soil much more friable and mellow, and the working of it becomes a pleasure instead of an irksome toil, as is often the case. Indeed, I have seen many undrained places where the soil had become so packed after heavy rains, that the labour of cultivating it was almost as great as it was to break it up in the first instance. Then again, land that is drained can be operated upon in a very short time even after the heaviest rain, whereas weeks will sometimes elapse on undrained land before any work can be done, and during which time the water lying in the ground is doing very serious mischief, especially where orchards and vineyards are concerned, for the young rootlets, which should be always growing and gathering nourishment for the tree, will be completely destroyed by rot, and the result is seen by a paucity of foliage or an inferior and deficient fruit-crop; and the majority of the young wood sprays, that should be developing to carry the next year's crop, die off. The health of the tree is impaired, and unless remedial measures are speedily taken it soon dies, a victim to cold and wet.

Throughout the Colony thousands of trees are annually lost in this way. Neither do trees ever attain their full size on undrained land, even where its demands are not great; consequently one must never expect to get the best obtainable returns without drainage. Then, for comparison sake, visit an orchard that has been intelligently treated in the matter of drainage. See the luxuriant growth, the wide-spreading nature of the trees, and, above all, in due season, the large crop and fine development of luscious fruit, and conviction as to what is necessary to be done will speedily follow.

Underdrainage prevents water running over the surface, and causes all surplus rain to find its way to the drains through the soil, thus adding fertility to it; whereas, were the water to flow over the surface, an immense amount of fertilising matter would be carried away—much more than is generally supposed. Thus on drained land heavy rain is a blessing instead of a curse. By drainage the soil is kept warmer and drier, and the best conditions for plant growth are obtained. It also helps in no small degree to resist the effect of the dry seasons that we are liable to, for it puts the soil in that loose, mellow condition that enables it to hold more water without at any time having too much; and further, the healthful condition of a well-drained farm will be much greater than where it is otherwise. Consequently drainage confers an inestimable boon upon the residents of the farm, as well as upon the trees on the land. There are many, very many, reasons that could be given in favour of drainage did space allow; but this I will say, in concluding under this heading, that I firmly believe that everyone who cultivates the soil can double the producing power of his land by it, not only in quantity but also in quality; and, as to quality, it will, I am sure, be freely admitted that there is ample room for its improvement, for as far as my experience goes we do not at the present time produce sufficient really first-class fruit for our own market. Until we turn the thousands of tons of second and third-class fruit that annually crowds our markets into a first-class article it will be useless for us to think of exporting to any great extent; and I say confidently that this change will never be effected while drainage is neglected.

How we should Drain.

In dealing with this part of the subject there will be several points to consider—the nature of the soil, the kind and size of drains, the quantity of water that it will be necessary to carry off in a certain time, distance apart of drains, best mode of laying them, &c., &c.

Where the soil is of a clay nature I would not advise sinking the drains to a greater depth than 2 feet 6 inches. Below that depth it will be found as a rule that the clay becomes very compact and impervious to water, so that were the drain laid deeper it would not be fully effectual, and I do not think in this sort of soil that they should be more than 20 feet apart. In soils of a more friable and open nature it may be necessary to put the drains much deeper, but then not so many of them will be required.

As to the kind of drain to be used, I think it will be admitted by all who have any experience in this work that there is nothing to beat the well-burnt earthen pipe, or, as it is commonly called, the tile drain. Of course where stone can be obtained readily and cheaply, and economy a necessity, good useful drains may be constructed by breaking the stone to about a 4-inch gauge and putting 9 or 10 inches in the bottom; but it must be remembered that with such drains there is always a liability to silt up and become inoperative, when all the work will have to be done over again; whereas with well-made and well-burnt pipe drains there is no limit to their duration.

It is most important that the drains should have a sufficient capacity to carry off the surplus water in as short a time as possible, and to this end careful calculations will have to be made. It has not been an uncommon practice in determining the size of drains to calculate for the average annual rainfall, but a moment's thought will show that this plan would only answer in a country with a very even rainfall. But here, where at times we are subject to lengthy periods of drought, and at others to phenomenal falls of rain, it will be necessary to make provision for the latter, so that as short a time as possible may elapse between the fall of the rain and the surplus being cleared off the land. This is one of the points that requires good attention, for it does not take stagnant water long to do a great deal of mischief. Formerly, and still, to some extent, very small pipes were used for laterals, but the tendency of late years has been, and I think wisely, to increase their size. I would not advise anyone to lay down anything less than a 2-inch lateral, and of course the size of main drains will have to be regulated by the number of laterals connecting with them, which in turn will be determined by the area to be operated upon. By all means have the drains too large rather than too small.

How the drains should be laid: This part of the business requires the greatest care, for upon the pipes being well and truly laid depends the success or failure of the whole scheme. The ground to be drained should, in the first instance, be carefully surveyed, the lowest points ascertained, and the lines for the main drains marked off, after which it is an easy matter to range out the lines for the laterals. Then if it is possible to use a plough the top foot of the excavation may be opened by this means, not much labour being required to throw the loose earth slightly to one side, after which the remaining depth must be removed by manual labour, using spades suitable to the work; and it is in digging this lower portion that great care is necessary so as to get an even grade in the bottom, otherwise a good deal of extra labour will have to be expended in obtaining it. A true grade for the pipes to lie on is of the first importance. Should there be any hollows

in which water would lie you may be sure the tree roots will find them out. The roots will enter the drain joints, continue to grow, and eventually choke it. This is a point that too much stress cannot be laid upon. With regard to the actual work connected with draining I would advise anyone in the first instance to procure a complete set of suitable tools. These will not be found to run into much money. By doing this the work will be much expedited and labour economised. When the pipes are laid about 6 inches of clay should be laid over them. This should be firmly and carefully trodden down, after which the remainder may be filled in by any sort of labour. Possibly using the plough will be found the most expeditious plan of turning the soil back.

Every area to be drained will have its own peculiarities, and it is only by a complete and detailed study of each individual case that anyone will be able to arrive at what is the best and most economical course to be pursued; and I would strongly advise anyone who contemplates draining to any extent, if he has not had any previous experience, to consult some one qualified to advise on the subject. By so doing a good deal will be saved both in vexation and cost. The work will be reliable, and a little outlay in this respect will be found a great gain in the end. I would say to any intending orchardist, by all means in the first place drain your land, for by this the great cost often incurred in trenching may be saved. Of course, if one can afford to drain and trench as well, possibly so much the better, but I am of opinion that land broken up with a heavy plough to a depth of 14 inches, and thoroughly under-drained, is sufficient for all purposes. The drains will cause the bottom soil to disintegrate sufficiently for the roots to penetrate; and I would point out that trenched land without under-drainage is really a great deal worse than were it not trenched at all, for it only aggravates the evil by being in a condition to hold an immense quantity more water that has no possible chance of getting away.

As to when we should drain, I would recommend starting the work, if possible, early in the autumn, after the first rains have fallen, making the ground sufficiently soft to allow of easy and economical working, rather than leave it later in the year, when the ground becomes saturated and sloppy to work; and it will be found when growing plantations are to be operated upon, if done early in the year, that a very marked difference will take place in the next season's results. In many cases it will be found that the extra yields, both in quantity and quality, will be sufficient to pay for the whole cost of the drainage.

Finally, I would say, and say it advisedly, that thorough drainage is the beginning and end of all successful cultivation. It is the keystone of the whole structure. Without it you may cultivate, manure, spray—in fact, do everything on the surface in the most perfect manner possible, but without thorough drainage you will never reap a full and adequate return for your labour and expenditure.

On the Choice and Use of Artificial Manures.

BY F. B. GUTHRIE,
Departmental Chemist.

CROP REQUIREMENTS—*continued.*

Leguminous Crops.

Comprising such crops as the pea, bean, lupin, lucerne, clover, vetches, &c., stand midway between the cereals and root-crops with regard to the amount of fertilising materials they contain. The following numbers show the composition of beans and of red clover.

Beans.—A crop of 30 bushels grain consists of 2,000 lb. grain and 2,200 lb. straw, and contains 99 lb. nitrogen, 67 lb. potash, and 29 lb. phosphoric acid.

A *Red Clover* crop of 2 tons contains 102 lb. nitrogen, 83½ lb. potash, and 25 lb. phosphoric acid.

In addition to the above, leguminous crops contain a large proportion of lime, amounting in the clover crop to 90 lb. None of the cereals contain more than 10 lb. lime in the entire crop. Potatoes contain about 27; mangels, 43; and turnips, 70; so that it will be seen that the proportion of lime in the leguminous crops is considerable. They thrive best on calcareous soils, and derive special benefit from the addition of lime as a manure. But the most striking peculiarity about this class of plants lies in the fact that they can be practically independent of the soil for their supply of nitrogen. It has long been a vexed question, and is still undecided, whether plants are able to utilise the nitrogen of the air by means of their leaves. There is no satisfactory evidence hitherto of this fixation of nitrogen by the leaves of growing plants, and it is quite certain that the amount thus obtained is inconsiderable, and not sufficient to enable them to thrive independently of the soil-nitrogen. The case of leguminous plants is, however, quite different, and exceedingly interesting. It appears from experiments of Hellriegel and Willfarth, and, later, of Lawes and Gilbert, on peas, lupins, vetches, and lucerne, that there exist in the root-nodules, or small excrescences on the roots of these plants, certain minute organisms which are capable of assimilating free nitrogen and of rendering it in an available form to the plant. These organisms act, therefore, as carriers of nitrogen between the air and the plant, and the root-tubercles become a storehouse from which the leguminous crop derives its nitrogenous food. The air from which the nitrogen is thus withdrawn is the air in the interstices of the soil, and as this is continually renewed, especially in the case of a porous soil, from the outside air, the supply of nitrogen is practically an inexhaustible one. The form and appearance of these nodules vary somewhat in the different plants, being generally large or small swellings on the root or root-fibres, sometimes single and sometimes agglomerated. It is generally believed that the soil-nitrogen is drawn upon in the first place, and that it is supplemented by the

nitrogen obtained from the air by the above method of fixation. Though leguminous plants exhibit this peculiarity in a special degree, there is reason to believe that other plants are able to fix nitrogen from the air in a similar manner, though in a much smaller degree.

On account of this property possessed by leguminous plants, such plants derive little or no benefit from the application of nitrogenous manures,—in fact, it has been observed that the formation of root-tubercles is reduced, or even stopped entirely, by the addition of much nitrate.

The manures that particularly benefit leguminous crops are such as contain potash. Taking further into account the proportion of lime necessary, the following would be found a useful average formula. A dressing of lime in the autumn, say 1 ton to 1½ tons per acre, followed by a top-dressing to the crop of 3 cwt. superphosphate and 2 cwt. kainit per acre.

Green Manuring.

Not only do the above-mentioned class of crops require no added nitrogen, but they actually enrich the soil in this ingredient. The land on which such a crop has been grown contains a larger proportion of nitrogen than before. This property is turned into account in rotating crops. When clover is grown between two crops of wheat, the second wheat crop derives the benefit of the nitrogen accumulated by the clover. It also suggests a means of supplying nitrogen to the soil without the addition of nitrogenous manures. If a leguminous crop is grown, and is ploughed into the land just before it reaches maturity, a manure is thereby added to the land containing about 100 lb. of nitrogen to the acre, that is to say, the land has received a manuring of nitrogen equivalent to that produced by the addition of 4 cwt. sulphate of ammonia or of 8 cwt. of dried blood per acre. Of course, with such treatment, the land is occupied for a certain length of time (dependent upon the rapidity of growth of the crop), and the crop so grown may be utilised to better advantage. The crops suitable for green manuring are, therefore, those that mature most rapidly, and occupy the ground for the shortest time, and which are otherwise of no great value. Perhaps such crops as the cow-pea, or vetches, or clover generally meet these requirements, but the choice will depend upon the surroundings of the individual. The crop may be fed as pasture to cattle, in which case a small proportion of fertilising matter is lost, which is nearly compensated for by the use of the crop as fodder. Another advantage of green manuring lies in the fact that by the decay of the crop thus ploughed in a supply of humus is produced, and the vegetable acids and carbonic acid produced by the decay of the plant assist in the decomposition of the soil and the liberation of available plant-food. They also bring up considerable quantities of plant-food from the subsoil. Clay soils are specially benefited mechanically from the ploughing in of such crops.

Fruit-trees.

Of the manuring required for orchard-trees and its application, I do not propose to discuss, as the matter has been carefully treated in these pages, in the December, 1893, number of the *Gazette*, by Mr. Benson. All fruits contain considerable proportions of potash and phosphoric acid, and of nitrogenous matter; moreover, the assimilation of nitrogen promotes the formation of sugar in the fruit, so that it may be generally said that a good general manuring, containing lime, potash, phosphoric acid, and nitrogen, is essential for the production of fruit in highest excellence, in addition to the

mechanical treatment of the soil by effective draining, &c. Analyses of the ash of the different fruits grown in New South Wales are being conducted in the laboratory of the Department, and when these are completed we shall possess more accurate data on which to base the necessary calculations for the formulæ of manures than we possess at present, being dependent upon analyses of European and American varieties, which differ so largely amongst themselves as to render it more than probable that our own fruits differ in composition from them, grown as they are under different conditions of soil and climate, and that they will require correspondingly different treatment.

In the above notes we have attempted to realise the principles on which the successful application of manures depends. We have found that different crops not only require special foods, but that they require such food in a form which varies in different cases, and that in deciding upon the manure to be used in any particular instance it is of first importance to know the form in which the food required by the crop is most readily availed of by the crop. Second in order of importance are the composition of the crop and of the soil.

In the next number the source and composition of the principal simple manures will be discussed.

Here follow a few rules with regard to the precautions to be taken in the use of artificial manures:—

1. When purchasing a manure always insist on a guarantee of its composition as determined by analysis.
2. It is as a rule better to purchase simple manures, and to mix them yourself in the proportions requisite for the particular case rather than to buy complete fertilisers ready mixed. In the first place, the simple products are much less liable to adulteration, and the adulteration is much more readily detected; in the second place, you will avoid purchasing and paying for an excessive quantity of an ingredient which may not be required in the particular case for which you are using it; and in the third place, you save the cost of mixing. As these artificials are seldom required in greater quantities than can be easily mixed by hand, the trouble involved is very small. The simple manures are:—Bonedust and superphosphates, containing phosphoric acid and nitrogen; dried blood and sulphate of ammonia, containing principally nitrogen; kainit, sulphate of potash, and wood ashes, containing potash; lime, gypsum, &c., containing lime.
3. Soluble manures are best applied when the plant is above ground.
4. All artificial manures should be mixed with about three times their weight of dry loam, and distributed evenly.
5. Soluble manures should be used with caution on very porous soils.
6. Soluble manures are applied superficially; and the insoluble manures can be harrowed in lightly.
7. They should be used in conjunction with farmyard manure as a rule.
8. Never add lime to a manure containing nitrogen; and when lime has been applied to the land do not use such manures until about three weeks afterwards.
9. The depth of applying the insoluble manures will be regulated to some extent by the length of root of the crop, but as a rule it is not advisable to manure to too great a depth.

Chemical Notes.

A few simple Hints for detecting Adulteration in Artificial Manures.

It must be premised that it is of no use attempting the roughest analysis of a manure without a fairly accurate balance. The substances likely to be added as adulterants, or whose presence in quantities lower the value of the manure, are not foreign matters, but those like sand which already exist in the manure; therefore, all attempts to decide the value of a manure must depend upon an estimation of the quantities of the ingredients present, and these cannot be estimated without a balance which must be capable of weighing half a grain.

In the absence of such an instrument the following rough tests may be found useful in giving an approximate idea of the purity of a few of the simple fertilisers:—

Bone-dust.—A good sample of bone-dust, however fine, shows the bony structure in some of the larger pieces. It should be as dry as possible, and in a fairly fine state of division. It should have the characteristic smell, though there is no need that the smell should be offensive. It does not follow that a bone-meal is necessarily good because the smell is disgusting—indeed, some of the best samples of bone-meal received at the Department for analysis have been nearly free from smell.

Take about 100 grains in a small iron spoon or ladle; heat it strongly in a brisk fire. The heat should be applied cautiously at first to avoid loss by spurting, after which it may be heated as strongly as possible. Any moisture present, all the organic matter, and carbonic acid are driven off by this means, and the "ash" left behind contains phosphate and oxide of lime, and magnesia, with a small quantity of alkalies. This ash should be quite white if the bone-dust is pure, although it may require some patience and a pretty hot fire to get it white. This ash is now allowed to cool, and emptied into a glass beaker or a basin which will stand heat. If such a vessel is not at hand, a small enamelled saucepan may be pressed into the service. Pour into the ash in this vessel about half-pint water and a few ounces of hydrochloric acid, and boil well for about five minutes. The substance should dissolve completely in the acid, or leave only a very small residue. If there is any considerable residue left undissolved, the presumption is that sand has been mixed either purposely or accidentally. Allow this acid liquid to cool; pour it off from the sand into a tumbler or glass jar. A rough indication of the quantity of phosphate of lime present may be gained as follows:—Add dilute solution of ammonia until the liquid smells of ammonia. This will form a dense white precipitate of phosphate of lime, and a little practice will enable you to judge from the bulk of the precipitate after it has stood for two hours of the relative proportion of this ingredient in the manure. If the same quantity (100 grains) be taken in each case, you will know what

quantity to expect from a good sample. If no precipitate, or only a slight one is formed, the manure may be discarded. I know of no method by which even an approximation of the nitrogen can be made without apparatus. As sand is the most likely adulterant, it will generally be sufficient to test for it as above. This method will detect sand in bone-dust, dried blood, and such products.

Sulphate of Ammonia should be a whitish crystalline powder, fairly dry and friable. It should dissolve completely in water without leaving any residue, and on placing some in the iron spoon used in the test for bone-dust, and heating it strongly in the fire, it should completely volatilise, leaving no ash. A fair idea of its purity may be inferred from the quantity of the residue thus left. A perfectly pure sample would volatilise completely, leaving the spoon perfectly clean. If a little of the powder be mixed with slaked lime, and heated in the spoon, a strong smell of ammonia will be given off. If there is none, the substance is not sulphate of ammonia at all, nor any ammonium compound. Dissolve a little of the salt in water, and add a few drops of ferric chloride, which can be prepared by dissolving a little iron rust, scraped off a rusty iron implement, in hydrochloric acid. If a deep blood-red colour is produced by this reagent, the manure should not be used, as it contains a compound which is injurious to plants, namely, sulphocyanide of ammonium. The solution of sulphate of ammonia should not alter the colour of blue litmus paper; if it turns red, the salt contains free acid and should not be used.

Kainit should be a crystalline powder, resembling common salt, more or less white, often of a reddish or darkish tinge, generally damp to the touch. It should almost entirely dissolve in water, and should be completely soluble in water to which a little hydrochloric acid has been added. The potash cannot be estimated by any simple method with any degree of accuracy.

The above tests require no other reagent than a little hydrochloric acid and ammonia, and though they are not, in any sense of the word, accurate analyses, still they may prove useful when there is any doubt about the purity of any of the substances in question.

With the help of a balance which will indicate half-grain, such as any druggist possesses, the following scheme will enable a fairly close estimation being made of bone-dust.

The following articles and chemicals will be required:—A balance (turning to ½ grain), pure hydrochloric acid, pure ammonia, a packet of cut filter papers, glass beaker, pestle and mortar, a sieve of eighty meshes to the linear inch, porcelain basin, a glass funnel, some strips of litmus paper. These can all be obtained at the local druggists.

It is very important to obtain an average sample of the bone-dust. To do this, if the sample is contained in one bag, empty it out upon a clean board or floor and mix it well with the shovel. If in two or more bags, take a sample from the middle of each bag and mix them as above. From this mixture take about a spadefull and grind it thoroughly in the mortar until the whole of it has passed through the sieve. The sifted sample is again mixed and is ready for analysis.

A piece of glazed writing paper is placed on one of the pans of the balance, and exactly counterpoised by placing a similar piece of paper in the other pan. Weigh out exactly 200 grains of the finely-powdered manure upon the paper, introduce it without loss into the iron spoon, heat very gently at first and then gradually more strongly until the ash is white. Care must be taken not to lose any by spurting. Allow to cool, empty back again upon the paper

without loss and weigh. The weight now should not much exceed 80 grains. This is now emptied again into the porcelain basin, about half-pint water added, and about three ounces strong hydrochloric acid. Boil well for about five minutes, add a little more water, and filter. Filtering is done as follows: Fold one of the round papers in half , now fold again in half at right angles to the first fold . On opening this out it will be found to fit exactly into the funnel. The funnel with the filter-paper is now supported over a beaker placed below it. The liquid in the dish is now poured through the filter, rinsing it out with water so as to get all the sand on the paper. The paper with the sand is now placed in the oven until quite dry, and weighed. If a second filter-paper be placed in the other scale, the weight required will represent the weight of sand. This should not be more than 3 or 4 grains. This number divided by two will give the percentage of sand and insoluble matter in the bone-dust.

The filtered liquid is now neutralised with ammonia—that is to say, ammonia is added till the solution turns red litmus paper blue. Allow this precipitate to settle and filter again in the same way as the sand; dry and weigh as before. The weight of this precipitate divided by two gives the percentage of phosphate of lime in the bone-dust. This should not be less than 40 per cent.—that is, the precipitate should weigh at least 80 grains. The above scheme does not pretend to scientific accuracy, but it will give a fair approximation to the actual composition.

As the efficiency of a bone-dust depends much upon the fineness of division, it is as well to grade it roughly by passing it through a sieve with twenty-four meshes to the linear inch. Three-quarters of the weight of the manure (75 per cent.) should pass through the sieve.

It must be thoroughly understood that the above tests are only intended as a rough guide as to the purity of a manure. If the quantity of impurity is found to be excessive, a sample should be forwarded to a qualified analyst for his report.

Analysis of Bone-dust.

The following is an example of a good quality of bone-dust offered by the Soap and Candle Company, Kent-street:—

Moisture	=	7·72	
Organic matter	=	36·75	(containing nitrogen = 4·06)
Sand and insoluble matter ...	=	1·12	
Tri-calcium phosphate ...	=	49·61	(phosphoric acid = 22·71)
Other lime salts, calculated as carbonate ...	=	4·37	

Mechanical condition.

Fine	=	42·5	per cent.
Medium	=	53·0	,,
Coarse	=	4·5	,,

This is in every respect an excellent sample of bone-dust. The value of the fertilising ingredients is £6 5s. per ton. It is offered at £4 10s. per ton, and at that price should prove an economical fertiliser.

An analysis of a sample of this firm's bone-dust was made last year, and published in the *Gazette*, from which it will be seen that they have succeeded in considerably improving the quality of their product.

The Spaying of Cows.

By W. J. STEWART McKAY, M.B., M.Ch., B.Sc.

In the following paper I propose to give an account of the operation of spaying as performed on cows. I intend to divide the paper into four sections. In the first I shall give a description of the yard, bail, and instruments required. In the second section I shall give an account of the anatomy of the parts, written rather for students and those understanding the anatomy of the cow. In the third part I shall describe the steps of the actual operation, and shall finish by giving an account of the results on the cows spayed and the conclusions to be drawn from the experiments. My experience has been gained from taking part in the spaying of forty-two head of cattle. These were generously supplied by Mr. S. Burdekin, and Mr. Lamrock of the Kurrajong, who has had considerable experience in spaying, was good enough to give us demonstrations, after which I, with others, did the operation on various cows. The youngest calf dealt with was about two months old, and at the other extreme were some old cows very poor in condition. Between these classes were cows in calf, young heifers, and cows that had just calved; in fact, every variety that could reasonably be supposed to occur. In addition to the operations on the live stock, I have taken the opportunity of dissecting the parts in a freshly-killed cow, kindly placed at my disposal by Mr. Percy Lamb. I have, from this specimen, been able to study the position of the parts in the body, and after the removal of the uterus and ovaries I have had the vessels injected in order to ascertain the blood supply to the ovaries, &c.

The Yard, &c.

The yard constructed by Mr. Burdekin for our purpose was suitable for about eighty head, and was constructed on the following plan:—

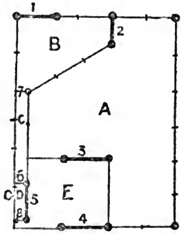


Fig. 1.

It was about 50 ft. long and 40 ft. wide. A is the chief yard and leads in by gate 2 to B, which is much smaller and triangular in shape. It is entered by gate (1) and leads by gate (7) to C, the crush, which should be made narrow, else the cattle will turn in it; and the posts in the fence on either side should have the edges smooth and not projecting too far, so that the cattle will not knock themselves about too much. The crush leads into D by the gate (6). The gates (7 and 6) should open towards the yard B, and when closed a stout bar of wood should be put on the side of B, so that

if a cow runs back she will not knock the gate off its hinges. The bail yard D has the fence on the left side, a gate (6) behind, and one (5) on the right side, and the bail (8) at the end.

The bail is constructed on the following plan:—

Two strong posts A and B are joined by double cross-bars C and D, while E reaches from the angle between C and B down to D, in order to strengthen the bail, and to prevent the cow rushing through between F and B. F is a movable piece fixed to the cross-pieces D at X, and sliding between the upper cross-pieces C. The distance of X from the post A is about 6 inches. To this movable piece F is fixed a rope, which passes

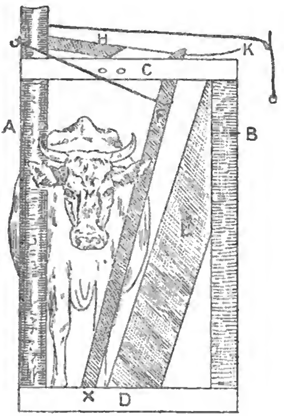


Fig. 2.

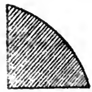


Fig. 3.

over a pulley near the top of the post A, then, passing round the post, it is carried across to the near side, and allowed to hang down by B. The top of the movable piece F is rounded off, as shown in the figures 2 and 3. When the rope is pulled F slips up towards A, and hitting against an iron frame H,* this is thrown up, and the top of F slips under it, and is caught. The iron frame H is fixed by a pivot into the post A, and it has a long handle K, which is raised when the upright F is to be let free. The bar of H that catches F should be about 9 inches from the post A, but as this may not be close enough for young cattle, it is well to have some holes in C in which the ordinary pegs can be placed.

The gate 5 (fig. 1), leading from the bail, next calls for description.

In fig. 4 is seen a double gate. The chief gate (unshaded) swings on the post A, and is so swung that it will open into the bail or out into the yard, as shown in (fig. 5). This is a very important point, inasmuch as it is by pressing the main gate inwards, so as to meet the hind quarters of the cow, that we keep her still during the spaying.

The second gate suggested itself to me after we had finished the spaying, for it was found that the bar D (fig. 4), when carried on to the upright C was so much in the way that it had to be cut out, and a temporary bar held in while the cow was being placed in the bail, the consequence being that some of the wild cattle jumped through the bars. This second gate would then be of great use while the cow was being bailed up; after she was safe it would be opened, and the operator would have plenty of room.

* H is a quadrilateral iron frame, not a solid bar, as shown in figure.

For large cattle perhaps it would be better if the cross-bar E met the lower bar at F (fig. 4). Outside the fence, on the off-side of the bail, a stout post A (fig. 5), should be fixed for the leg-rope, which is put on the

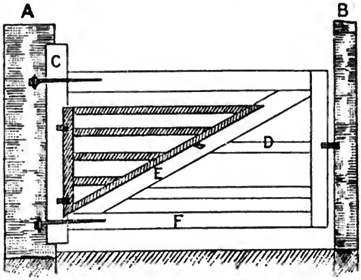


Fig. 4.

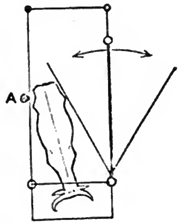


Fig. 5.

near hind leg, and carried round behind the cow, and put round A, or held there by some one. When the spaying is finished the cow is let out through yard E (fig. 1), by gate (4).

Instruments, &c., required.

A strong triangular needle, with very sharp point and edges, about 3 inches long.

A sharp knife, shaped like the ordinary castrating knives, with the curved edge.

A number of pieces of sailmaker's twine, cut into lengths of a yard or more.

Some Stockholm tar and fresh dripping. Mix about six parts of tar to one of dripping. This allows the tar to be more easily applied to the wound.

A bucket of water, towel, and soap.

The anatomy of the regions concerned in spaying.

When a cow has been kept without food for some twelve hours or more there is noticed just immediately in front of the hip a well marked triangular depression, which allows a stockman to tell whether a cow is "hollow" or not. This is the region in which the incision for spaying is made.

The triangular area is formed as follows:—The front (anterior) border is formed by the last rib, the hind (posterior) border by the projection of the hip-bone (ilium), and a distinct chord of muscle (flesh) which runs from the projecting part of the hip-bone downwards and forwards, and which is merely a fold of the abdominal (belly) muscles presently to be described.

The upper (dorsal) border is formed by the transverse processes of the lumbar vertebræ covered on top (dorsally) by the erector spinæ muscle, and underneath (ventrally) by the quadratus lumborum. These parts are quite

familiar to every one in the sirloin of beef, the uppercut being part of the erector spinæ, the bones with marrow (cut through) are the lumlar vertebrae, the rib-like bones between the upper and undercut being the transverse processes, the undercut being the quadratus lumborum furthest from the marrow end, and psoas muscle nearer the "marrow end," while the "end" makes up the area A (fig. 6) of the triangle, and is composed of the muscles now to be described, and is the part cut through in spaying.

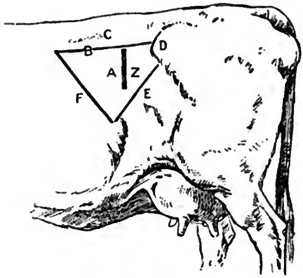


Fig. 6.—B, F, E is the triangle described above; F the last rib in front; E the fold of muscle behind; B the erector spinæ muscle and transverse processes of the lumbar vertebrae; C is the erector spinæ (the uppercut); D the hip-bone (ilium); Z is the line of the incision for spaying; A is the area described in the text as made up of the abdominal muscles.

When the skin (sk. fig. 7) has been dissected from the area A (fig. 6), we find that the first muscle met with is the panniculus; the muscle known to all as a red sheet, on which butchers are fond of cutting various figures when the sides are hung up in their shops. The muscle does not extend over the whole of A, but as far as its lower part. It adheres firmly to the skin. After this we come on a layer of fat (ft. fig. 7). Then on the first layer of muscle, called the external oblique, the direction of whose fibre is from the ribs downwards and backwards (ext. o, fig. 9). This being cut through, we come on a layer of fat and then the second layer, called the internal oblique (int. o, fig. 7) with fibres running in the opposite direction. Then another layer of fat and the third layer of muscle, called the transversalis, with the fibre very much in the same direction as the external oblique (fig. 7, tr.). Then a layer of fat and a thick layer of white tissue, called the fascia transversalis (fig. 7, x). On removing this we come on the last layer, called the peritoneum, which is easily recognised by its shining appearance and by the fact that as soon as it is torn through the air rushes into the belly with a loud gurgle.

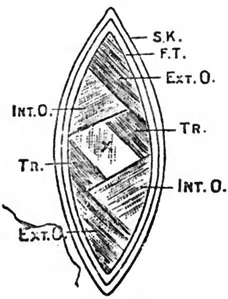


Fig. 7.

There are no arteries of any great size passed through, nor yet veins or nerves.

The best idea that can be obtained of the position of the organs of generation in the cow will be to view the parts in a slaughter-house, when a cow has been killed and hung up by the hind legs.

D

When viewed in this position we see the parts as shown in fig. 8, which was sketched from a cow thus suspended.

Coming from the tail-end forward, we first encounter the bladder B which is seen as a ball (if empty) about the size of an orange. Behind and

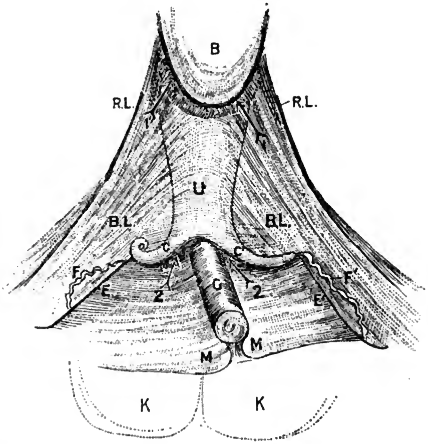


Fig. 8.—Position of the organs of generation in the cow when the animal is hung up by hind legs; B, bladder; RL, round ligament in fold of peritoneum running down to bladder; U, the body of the uterus (bearing bag); the arrows (1 1) point to the pouch between B the bladder and U the uterus; BL, the peritoneum at this position called broad ligament, it is in two folds, and the uterus and tubes are placed between the folds; the broad ligaments run to the sides of the animal and so keep the uterus and other parts in position; cc^1, the cornua or horns of the uterus; C, has the natural twist; E, is the sharp edge of the peritoneum; F^1F, the fallopian tubes leading from the horns of the uterus to the ovary which cannot be seen but is situated at about F; G, is the gut hung from the back by the fold of peritoneum M/M.; K, kidney. The arrow (2 2) point to pouch between uterus and gut.

below this hangs the uterus U or womb or bearing bag as the butchers generally call it. If we raise the bladder we shall see that a pouch exists between the bladder and uterus, and that the hand cannot be extended far behind the bladder, because the peritoneun runs off the front of the uterus on to the back of the bladder. The arrows (1 1) point to this pouch. The bearing bag is divided into two portions, the body of the uterus U, and the two horns or cornua (c c) which run out from the body at the end furthest away from the bladder. These horns are twisted as shown in figure at C, but they can be easily straightened out as shown at C^1, when it is seen that they bebecome narrower as they run out from the uterus. The next point that must engage our attention in the peritoneum. It is by means of this membrane that the uterus and ovaries (stones) are held in position. If we look at (fig. 8) we shall see that the membrane runs over the uterus and extends out in either side as BL (called the broad ligament). We have seen that near the

bladder it forms a pouch by running off the front surface of uterus OD to the back surface of the bladder. If now we follow it forward it runs over the uterus and the horns CC, then round the horns to get to the back of the uterus, where we shall follow it presently. Where it turns back at the side of the horns we have a sharp edge formed EE, which is a valuable guide in spaying. If the sharp edge EE be examined now, we shall see just close to it a twisted tube F F[1] running in the peritoneum. This is the fallopian tube which conveys the egg from the ovary to the horn of the uterus. We cannot see the ovary unless the edge E is lifted up because the ovary lies on the other side of the peritoneum. If we introduce the hand between the uterus (U) and gut (G) we shall find that another pouch is formed on account of the peritoneum running off the back of the uterus in to the gut (G), this is called the pouch of Douglas.

To examine the position of the ovaries we must now remove the uterus and broad ligaments (BL), and lay them out, as shown in Fig. 9.

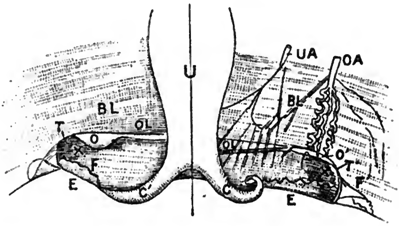


Fig. 9.—The uterus and broad ligaments have been cut out of the cow and turned over to show the ovaries. These parts are now in the position occupied by them in the animal :—U, the uterus; C, C[1], horns; E, sharp edge of the peritoneum; BL, broad ligaments; O, the ovary; O[1], the ovary has been cut away; OA, the ovarian artery entering the ovary at the points O[1]; UA, the uterine artery joined by a branch from the ovarian; OL, chord of muscle which enters the ovary, and is called the ovarian ligament; F, the fallopian tube; F[1] the trumpet-like end joined to the ovary at T; X, marks a pouch or depression in the peritoneum, called the "ovarian pouch," in which the ovary lies.

The ovary is seen (in Fig. 9) in the position which it occupies at the time we are spaying; that is, it lies on that surface of the broad ligament which is nearest to the backbone. It is an oval-shaped body, which varies in size with the age of the cow. In calves it is about the size of a green pea; in two-year heifers it is about the size of a broad bean; while in old cows it may be the size of a bantam egg or longer. It is attached to the broad ligament by one edge (Hilum), and when cut away from here a narrow oval surface is left in which the mouths of the ovarian arteries are seen as shown in (Fig. 9) O[1]. Being attached to the broad ligament by one side only, it drops forward into a depression immediately in front of it, and shown in the figure by the dark shading (X). It is attached by one end to the uterus by a chord of tissue (OL), and this must be cut through in spaying. Its other end has a portion of the trumpet end of the fallopian tube fixed to it at (T).

It will be noticed that the branches of the ovarian artery are very twisted, and that the uterine artery gives no branch to the ovary. The peritoneum

after turning back runs till it gets near the bladder (B) and turns forward over it, forming a second pouch, shown above in Fig. 8 (arrow 1), and in Fig. 10. The ovary O is seen resting on the upper part of the broad ligament close to the sharp edge E (Fig. 10).

We now see how to find the ovary, for if the hand is introduced from the near side, and carried up to the back the gut (G, Fig. 10,) hanging down will soon be found. If this is followed back the hand runs into the pouch (X) and therefore will rest above the uterus (U). This found, we carry the hand forward until we come to the horns on either side (C) One of these followed out will lead us to its curled end, and we shall then find the sharp edge (E). Raising our hand it will rest on the broad ligament (BL), and we shall easily find the ovary O.

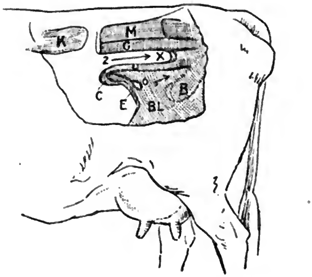


Fig. 10.—Compare this figure with figs. 8 and 9. A portion of the near side is supposed to be removed, and the parts are seen in the position in which they are when we are spaying. Near the back bone is seen, in front, the kidney K (figs. 8 and 10); behind this the gut (G) hangs from the back by (M), a fold or peritoneum (figs. 8 and 10); the peritoneum turns off G on to the top of the uterus (U); the arrow is pointing into the pouch thus formed and called the pouch of Douglas; the peritoneum runs forward in (U) and out on either side, as shown at B L; having reached the front of (C), it turns under the uterus, and at the side, the place where it turns back is marked by the sharp edge E.

We have now examined the parts from above and below, but to get an idea of the position of the parts in the body we must suppose that we are looking at the parts in the cow, after having cut away portion of the belly wall. Were we look in from the near side of the cow we should see the parts as shown in the diagram Fig. 10.

The Operation of Spaying.

1. The cow is placed in the bail (fig. 2), not in the position adopted for milking, but with the near side facing us.

2. The gate (fig. 4) is opened, and the leg rope put on the near hind leg, and carried round behind both legs to the off side, and fastened to the post A (fig. 5), or held by a man there.

3. The gate (fig. 4) is pushed well against the hind quarters of the cow (fig. 5) and the small gate (fig. 4) is opened.

4. The spot for the skin incision is chosen. Measure to a point $4\frac{1}{2}$ to 5 inches in front of the hip bone (D), along the well-marked ridge B. Place the left hand on the skin just near this point so as to steady it, then cut from the ridge B downwards in a straight line from 4 to 5 inches (line A, fig. 11.)

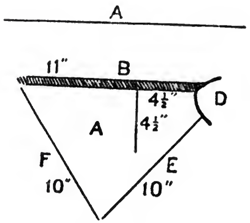


Fig. 11.—D is the hip-bone; A[1] is the mid-line of the back; B is the thick ridge forming the upper side of the triangle F B E: B is about 11 inches long on a full-grown cow; F and E each about 10 inches.

5. Having cut through the skin (during which time the cow will plunge about, and care must be taken that the operator does not get his arm jammed against the gate), we then cut through the layer of fat next met with, and we then come on the first layer of muscle (fig. 7, ext. o).

6. Cut a small nick in the first layer of muscle (flesh) about an inch long, and after that the knife is handed to the man holding the gate.

7. Push both forefingers into the cut in the muscle and tear the muscle for four inches or more up and down in the same direction as the cut in the skin.

8. Then push the fingers through the next layers of muscle and tear them in the same way.

9. A white dense layer of tissue is then met with (the *fascia transversalis*, fig. 7 x), this is torn through with some difficulty, and then we come on some fat, and lastly a thin shining membrane (the peritoneum) which is easily torn through. Care must be taken that we go through this last membrane, or we shall strip it off the belly wall and get our hand in between the dense membranes mentioned above and the peritoneum. The sensation when the hand is in this position is though our fingers were entangled in fine threads; this happened several times during our spaying.

10. On tearing through the last layer (peritoneum) we hear a gurgle caused by the air rushing into the belly cavity. The operator now faces the hind quarters of the cow and introduces his left arm into the abdomen (belly). The first thing that may be encountered is the paunch; but this seldom happens if the cow has had no food, or if not in calf.

11. The operator runs his hand not straight in front of him, but somewhat towards the tail and up towards the backbone.

12. Here we will find the bowel (fig. 10 G) hanging down from the middle line of the roof of the back, and following this towards the tail end his hand will get into a pouch (see fig. 10 x). Lowering the hand it will now be found to rest on the body of the breeding bag (uterus, fig. 10 U, fig. 9 U). Carrying the hand forward, the bag will be found to branch out into two

horns. Follow the left horn (fig. 10 C, fig. 9 C) which runs towards the operator and which may also hang somewhat downwards. At the end of the horn a twist will be found in it, and immediately we come on the sharp border (fig. 10 E, fig. 9 E) of the broad ligament. Now raise the hand above this sharp border and feel about for a small, hard, smooth body about the size of a cherry or a broad bean.

13. Seize this hard object (the ovary or stone) between the thumb and fore-finger, and holding it firmly (for it will easily slip), withdraw the arm slowly, carrying the ovary and the parts that hold it, to the hole in the belly wall.

14. When the ovary has been pulled through the incision and brought to the light, the parts will have the position as shown in fig. 12.

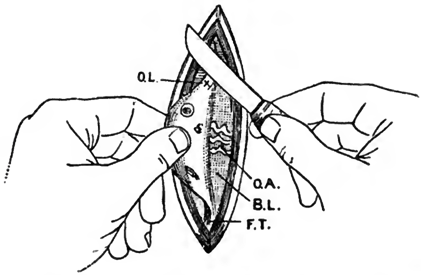


Fig. 12.—O is the ovary, OL the ovarian ligament, easily seen as a thick chord (see also fig. 9, OL): OA, ovarian artery entering ovary; BL, the broad ligament to which the ovary is attached by one side; FT, end of fallopian tube attached to ovary.

15. Now, take a knife and cut through the chord, at the upper part of the ovary, OL, and which is easily seen entering the ovary. Having cut this ligament through, the knife can be carried down close to the ovary, cutting away the broad ligament, which holds the ovary, and cutting through the ovarian artery OA, and, lastly, the end of the fallopian tube FT. It will be found better, however, to cut through the ovarian ligament OL, and then tear the ovary off. This can be easily done, and the sudden breaking of the tissues causes less bleeding than cutting with a sharp knife. (When the ovary has been removed, the edge left will appear as shown in fig. 9, O^1.)

16. Having removed the ovary, the parts will now slip back; and the hand being again introduced, the upper surface of the breeding bag is found, and the left horn is followed out and the left ovary found and pulled over in the same way. The ovarian ligament will generally be found at the lower part of the wound instead of at the upper part, because the ovary is turned upside down as it is pulled across to the opening. The ovary is now removed.

When the cow is heavily in calf.—The breeding bag will then be far forward and the ovaries are carried for some distance with it, and the paunch may be pushed far back, so that on the hand entering the belly cavity we must first carry it along the near side towards the hip so as to get round the end of the paunch, which can then be pushed out of the way. No directions for finding the ovary could be given, it is merely a matter of hunting for it.

In the case of young calves, the animal can be thrown on the ground and held while the incision is being made, then lifted on to its legs and the hand or two fingers introduced and the ovaries found. As the parts dealt with are very small the ovaries will often be found hanging almost together from either side of the uterus. These may be removed by catching each ovary between the thumb and fore-finger and cutting through the broad ligament with the thumb-nail without withdrawing the hand.

Closing the Incision.—After the ovaries have been removed the edges of the skin round the wound are drawn together with four or five stitches. The needle is pushed through the hide only, not through the muscles. When all the stitches have been introduced, the hide cut is smeared with the tar and grease.

The cow is now liberated, and goes through yard E, and out of gate 4 (fig. 1).

The after-care of the Cattle.

The cattle should be put into a paddock where they will not be disturbed. The grass should be green and have a spring in it. They may have water; and after a few days a little green lucerne to purge them. The stitches should be looked to, and if they give way the cow should be put in the bail and fresh stitches put in. If the flies get at the wound they often leave maggots, which must be scraped out and fresh tar applied. If an abscess forms around any of the stitches remove the stitch so that the matter can drain away.

Remarks on the Results obtained after Spaying forty-two Head of Cattle.

In the spaying of these forty-two head of cattle five operators took part, three of these having no experience in the operation and two being experienced hands, who did the majority of the cattle. The cattle were all ages—from two months to ten years. Of the whole number three died; of these, two were old cows in bad condition, one being in calf, and the third was a young heifer. This heifer was very wild, and had to be pulled into the bail with a rope. The first cow died on the ninth day after the operation, the next on the tenth day, and the next about the fourteenth day. Of the cows spayed, about fifteen were in calf and five slipped their calves, and of the calves four died.

I inspected the cattle thirteen days after the spaying, and found that the young cattle looked well, and that the stitches had given way in a very few cases. The old cows did not look so well, and many were evidently suffering from peritonitis judging by the manner in which they were distended with gas.

I went over the stitches on the twenty-first day, and found that in about half a dozen of the cattle the stitches had cut through, and that the wounds had suppurated. Fresh tar was put on, and after a week or two all the wounds were healed up.

If any conclusions can be drawn from the small number of cows dealt with, I should say that the following rules should be followed in spaying:—

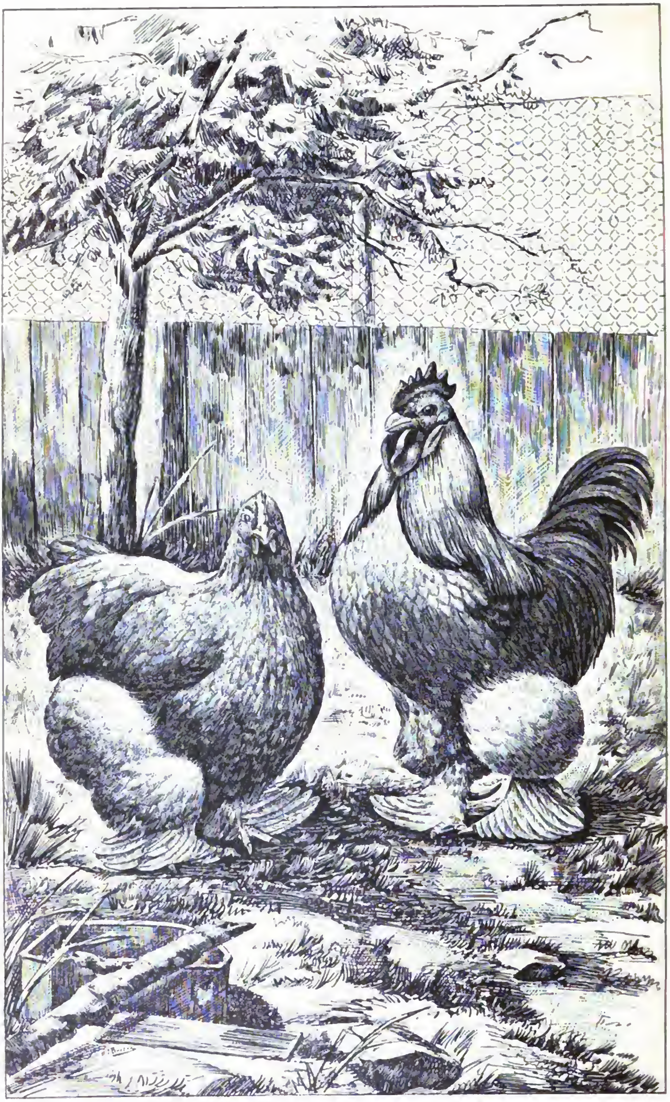
1. The time of year should be spring, before the weather gets too warm and the flies get too numerous, and also that the young grass aids the cure in providing rich fodder, and from the fact often observed that when cattle are purged they do better. There can be little

doubt that when the cattle get blown out with wind they should be purged. The wind collects in the bowels, and is, no doubt, in the majority of cases a symptom of peritonitis. I would, therefore, recommend the administration of the sulphate of magnesia in six to eight ounce doses when the animal looks " blown out."

2. The younger the animal the better chance of its getting over the operation well and quickly.
3. The cattle do not die from primary bleeding, as was shown by the fact that none died before the ninth day, and that, therefore, no ligatures are required after pulling off the ovary.
4. In many cases large pieces of the ovary are left behind, and there is no reason why the cow should not breed from these pieces. The point of this remark is that it is better to pull the ovary to the wound and see what is being done rather than pull it off by mere touch.
5. In order to prevent peritonitis the greatest care should be taken to have the hands and arms clean before introducing them into the abdominal cavity.

Concluding Remarks.

It may be asked what is to be gained from spaying cattle. It has long ago been proved that cattle that are barren get fat sooner than those that bear calves, and that if the cows are made barren artificially that they likewise become fat. Therefore, we may spay calves in order that they may become fat while still young, or we may spay cows that have had several calves in order that they may become fat, and we may thus get rid of old cows for beef, which would otherwise remain poor, and breed weedy calves. Lastly, it has been found that if a cow is spayed while in full milk that she will go on milking for months, and sometimes for years. A squatter has assured me that he has known a bullock, 5 years old, go on his knees so as to be able to suck at his mother, a cow that had been spayed four years previously. I might also point out that spaying may be used for the following case:—If one owns a well-bred cow, which, if a breeder, would bring a large sum of money, but if barren would only bring her price as far as beef was concerned, it may happen that the owner, after keeping her for some time, may be in doubt as to whether she is is calf or not. By placing her in the bail, and making the incision as in spaying, the point would be immediately cleared up. This may seem an out ot the way case, but Mr. P. Lamb has informed me of a case that occurred when a very valuable cow, after being kept for some years, was sold to a butcher for beef, and when killed was found to be in calf. In conclusion, I would say that there appears to be very little pain connected with the operation, and that after the skin is cut through the cow does not appear to suffer.



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BUFF COCHINS.

Poultry.

By S. GRAY,
Sub-Editor.

The Cochin.

There are two points in connection with the Cochin without mention of which any description of them would be incomplete. This breed of fowl is called the "father of the poultry fancy," from the fact that on their first exhibition in 1847 they created a vast amount of public attention, and in fact the popularity of poultry shows dates from that event. Previously, it is recorded, such shows were confined to the very few breeders who took to poultry as a hobby, but on the advent of the Cochin, poultry-keeping may be said to have become general amongst people of all classes. The other point is, that the Cochin is one of the breeds the improvement of which is due to English rather than to American breeders.

The breed originated in China, and, as already stated, the first specimens showing the characteristics of those we have at the present day reached England in 1847. Since that time breeders have worked patiently on until the present-day bird has become a wonder to all observers. The feathering is unique, the feathers having a larger web and finer and weaker shaft or quill than is possessed by any other breed, these peculiarities accounting for the beautifully soft downy appearance of the birds.

According to *Lewis Wright*: "A Cochin cock ought not to weigh less than ten or eleven pounds, and very large specimens range from that weight to as high as fifteen pounds; but the latter weight is very rare, and is generally, according to our observation, accompanied by a clumsy and ungainly carriage, though we have seen some exceptions to this rule. A good Cochin looks larger even than his actual weight, as the plumage is very loose and fluffy, a peculiarity which arises from the feathers being broader across the web, and thinner or weaker in the shaft or quill than that of other varieties. The comb is single, and should be perfectly upright, free both from twist and any tendency to fall over, with a fine arched outline and neat, handsome-looking spikes; both comb, face, deaf-ears, and wattles being as fine in skin or *texture* as possible. This point is greatly valued by fanciers, a rough, warty-looking skin being much disliked. The head, which should be carried slightly forward, is rather small and very intelligent looking; the neck rather short, and very thick and full in the hackle, which should be long enough to flow well over the shoulders and back; the shoulders somewhat square and very broad across; the breast rather high relatively, but should be prominent, full, and broad. The back so short as to have hardly any length at all, but wide and flat crossways, and running off almost at once into the saddle. This last is one of the most important points in a Cochin cock; it should be nearly or quite as broad as the back, begin to rise

almost from the very base of the neck, and rise more and more gradually towards the tail, forming no angle with the feathers of that member, but a nice, harmonious, continuous line. The body to be short, but very deep, and the 'fluff' on the thighs standing out as much as possible in globular form. This and leg feather form perhaps the second great point in a good Cochin. The hocks ought to be thoroughly well covered with soft, curling feathers, but free from stiff, projecting quills (vulture-hock), and the shank feathering heavy, standing out from the shanks well. The legs should be short, and as wide apart as possible. The tail and wings are also important, the tail of a good Cochin containing hardly any quill, but merely soft, curling feathers; and the small and short wing being well clipped up to the sides, and the points almost buried between the saddle-feathers above and the fluff below. The breed, in common with Brahmas, is peculiarly subject to what is called a 'slipped' wing, or the flight feathers protruding outside the secondaries instead of being nicely tucked under. This fault greatly diminishes both the value and beauty of a bird, and tells heavily in any good competition. The gait is slow, and the carriage quiet and dignified.

"The hen is of similar conformation as to shortness, width, and depth of body, the short neck rather tending forward, the high-carried stern, &c. In her, the saddle is exchanged, however, for a still more developed 'cushion,' almost globular in its fulness of outline, and which, with a similarly developed fluff on thighs, are the chief points in a Cochin hen. The tail is very short, and should just peep through the feathers of the cushion. In other points the conformation is similar. In both sexes the toes should be large, straight, and well spread out."

"The colours bred in Cochins are various shades of cinnamon, buff, partridge or grouse, white, black, and "cuckoo."

In keeping Cochins cleanliness is most essential, and the roosting-houses must be kept scrupulously clean. They are much better on broad planks littered with straw than on perches, such board forming a sort of roof to the nesting boxes. As will be seen from the weight, they make excellent table birds. They are fairly hardy, and the hens moderate layers. The hens also are good mothers, and their fluff helps to keep the almost naked chicks warm. I can hardly recommend them as a farmer's fowl, but a few running in a nice green paddock look very handsome, and can with proper attention be made to pay for their keep. The young cockerels are very easily made into capons. They will succeed better in the drier portions of the Colony.

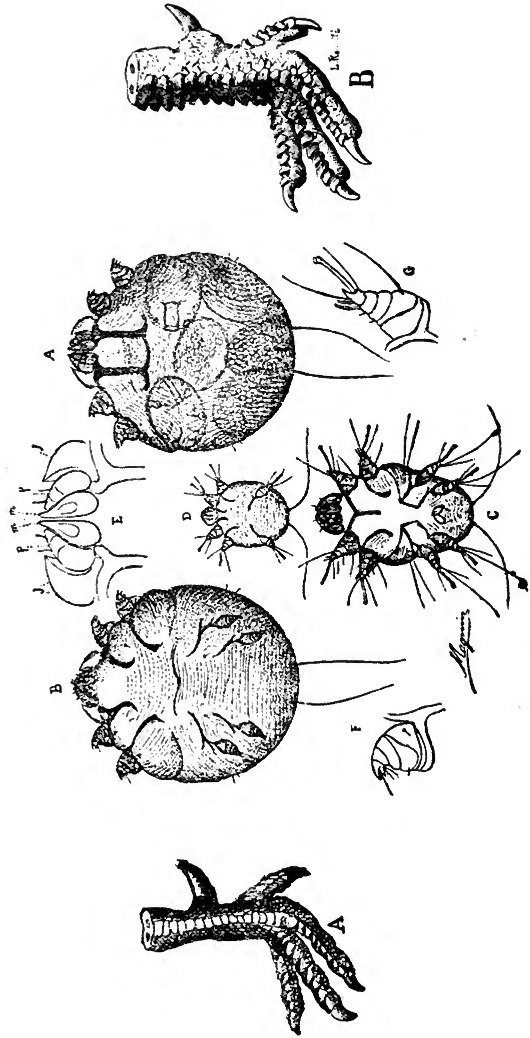
Having already given such a full description, I merely add schedule for colour of Buff Cochins and value of defects in judging:—

COLOUR OF LEMON-BUFF, SILVER-BUFF, OR CINNAMON COCHINS.

In both Sexes.—Beak rich yellow; comb, face, deaf-ears and wattles brilliant red, with as few small, spiky feathers as possible; eyes should match the plumage as nearly as possible, but red eyes are not objectionable; legs bright yellow, with a shade of red between the scales.

Colour of Cock—Breast and under parts any shade of lemon-buff, silver-buff, or cinnamon, provided it be even, and free from mottling; head, hackle, back, shoulders, wings, and saddle any shade of deeper and richer colour which harmonises well—lemon, gold, orange, or cinnamon; the wings to be perfectly sound in colour, and free from mealiness. Tail still darker in tint, but as free from black as possible, except in the darker Buffs and Cinnamons, in which black is not objectionable; white in the tail is very objectionable in any colour except whites.

Colour of Hen.—Body all over of any even shade, free from mottled appearance; hackle of a deeper colour to harmonise, free from black pencilling or cloudiness, cloudy hackles being especially objectionable; tail as free from black feathers as possible. Birds must match in the pen, and in matching different sexes, the hen's body-colour must match that on the cock's breast and lower parts.



SCALY LEG.

(11 b 53-94)

SCALY LEG.

Reference to Plate (page 347).

A. Healthy leg. B. Diseased leg.

Parasite (*Sarcoptes mutans*) present in the disease known as Scaly Leg.

A. Female front view; B. Back view of ditto; C. The male; D. Six-legged larva; E. Rostrum—mm, mandibles, pp. feelers, jj. cheeks; F. Front leg of female; G. Ditto male, nymphs, and young females.

VALUE OF DEFECTS IN JUDGING.

Standard of Perfection.		*Defects to be Deducted.*	
A bird ideally perfect in shape, size, colour, head and comb, cushion or saddle, leg-feathers, tail, &c., and in perfect health and condition, to count in points	100	Bad head and comb	10
If of extraordinary size, add on that account	5	Want of hackle	5
		,, cushion	8
		,, fluff	7
		,, leg-feather	12
		Vulture hocks	5
		Bad shape or carriage of tail... ...	6
		White in tail (where objectionable)...	6
		Primaries out of order	15
		Curved toes	7
		Stain of white in deaf-ear	6
		Faulty colour and marking	24
		Want of size	20
		,, general symmetry	15
		,, condition	12
		,, ,, (if total)	35

Our illustration represents a pair of Buff Cochins belonging to the Kingsgrove Poultry Farm Co., which took first prize at the recent Show of the Royal Agricultural Society at Moore Park.

SCALY LEG.

The following note has been kindly forwarded to me by Mr. J. J. M'Cue, of Moorside Poultry Yards, Telegraph Point:—

IN a recent number of the *Eleveur*, M. P. Megin, the expert poultry-fancier, gave some very interesting details concerning scaly leg, upon which I base the following remarks:—For a long time it has been known that poultry are liable to an affection of the legs, characterised by a superabundance of the scaly secretions of the epidermus, which has the effect of rendering them greatly enlarged and deformed. It has been compared, by some authorities, as resembling an affection which affects many human beings, called *ichthyosis*, in which the epidermus also becomes thick and scaly; but it was only in 1860 that the true nature of this affection was established. M. Reynal, at the time clinical professor at Alfort College, gave some fowls attacked with this complaint to Messrs. Lanquetin and Ch. Robin, for them to study. These savants discovered upon the legs of the fowls an acaridan parasite of a new species, which the latter gentlemen described and illustrated in a very elaborate manner, under the name of *Sarcoptes mutans*. The affection in question was therefore a true scab.

MM. Reynal and Lanquetin, in their notes upon scaly legs, state that it is their opinion that the complaint can commence either at the head or at the legs. This is an error; it commences always at the legs, and it generally remains localised upon them, but not always, as stated by Neumann, who asserts that the scales of the head (comb, &c.) are not due to the same cause as scaly legs; nevertheless, we have had under our observation many instances of true scale, or scab, of the comb, among cocks which were at the same time affected in the legs. These latter had inoculated their heads in scratching with their claws. Scaly legs have also been noticed among turkeys, pheasants, partridges, and even cage-birds, but the heads of these did not appear to be subject to scab.

In his work, La Langshan, from which above illustrations are taken, the author, M. Rouille, says of that variety:—"Like all the Asiatic breeds, it is subject to scaly leg. Reports which we have tried to obtain as to the soils which give rise to this malady to birds have been contradictory." In a footnote M. Rouille says—"Scaly leg is considered by some pathologists to

be a skin disease analogous to psoriasis (Laboultene); by others, as a parasite skin malady caused by acaridæ." Robin, Megnin, Frohner, &c., have discovered as present in the disease *Sarcoptes mutans*, which are capable of localising themselves on any part of the body.

Mr. Vale, an expert authority on diseases of poultry, and pigeons, &c., and a microscopist of recognised ability, says in one of his books (Roup and Kindred Ailments), we find, under head "Scaly Leg," the following:—"Symptoms—An accumulation of epidermic scales upon an inflamed surface. This condition is not due to parasites, as is generally supposed, but to tubercular disease, the cause of the inflammation. All fowls suffering from scaly leg should be destroyed."

That a gentleman of Mr. Vale's experience should have held this theory so lately as within three years is surprising, and shows how easy it is to be mistaken. That scaly leg is a parasitic disease is now well established, as is evidenced by above illustration.

Practical Vegetable-growing.

Directions for the Month of June.

The weather during the month of June is generally cold, and especially so at night, but notwithstanding this there should be vegetables in sufficient quantity for home use. When sowing seed or planting seedlings it would be advisable not to plant or sow the same piece of ground with the same kind of plant or one belonging to the same family. For instance, peas had better not be sown on the same ground where French beans had just been growing. It would be better to use the ground for cabbages, or, perhaps, some root-crop. It is not always practicable to carry out a proper rotation of vegetables, but as far as possible it should be done.

Everyone who has a garden, whether it be for vegetables, fruits, or flowers, should always save the ashes from the fires and spread them over the ground. They had better not be mixed with manure, for, if so, it is not unlikely that some loss may occur. Ashes are useful for several purposes, especially wood ashes. They frequently contain a considerable quantity of potash, one of the most necessary ingredients of all plants. They assist to sweeten the land, keep it open and mellow, and assist, considerably, towards the retention of wholesome moisture in the soil. Everyone who has anything to do with the soil should carefully remember this.

There should be no difficulty for every farmer who grows his own vegetables to collect abundance of good manure for all the requirements of the vegetables. There is nothing better in the world than the droppings of cows, horses, sheep, and fowls, and the liquid portion, if it be possible to retain it, is the most valuable. Pig-manure is objectionable for vegetables, for it sometimes imparts a disagreeable and offensive flavour. Whoever grows vegetables should aim not only to grow them well, but also to grow them with a good flavour, and this can be done by using well-rotted manure. The preparation of manure is by no means difficult. The droppings of the various animals should be well mixed together, and kept to ferment or rot under some sort of shelter, where the rains cannot wash out the best part of the manure. It should not be allowed to become dry, and this can be obviated if all the dish-water and house-washings are emptied over it daily, but it should not be made too wet. A little experience will soon show how to act, and how to make the best of manures. Bones burnt to powder will make a useful addition to the manure-heap. This is perhaps the best and easiest method of using them, for although all the nitrogen will be lost the phosphates will be saved, and this is the principal constituent of bones. When manure is well rotted, most, if not all, of the seeds of weeds which droppings (especially of sheep) are almost certain to contain, will be destroyed. On account of the weed-seeds alone the manure should be rotted.

Readers, of these suggestions for vegetable-growing, who are starting to work for the first time at making a vegetable-garden are advised not to grow their vegetables amongst their fruit-trees. There is always a great temptation to do so, but it is a mistake unless the trees are very young indeed. It is far better to set apart a piece of ground altogether for the vegetables; it need not be very large, but it should be kept clean, thoroughly well cultivated, and constantly under crop. The ground should be well drained, and, if possible, trenched 2 feet deep all over, including paths; and great care must be taken to have an outlet for surplus water, especially if the ground is stiff and of a clayey nature. When it is being trenched the top soil should not be turned over to the bottom, and the subsoil brought to the surface, but it should be managed that the surface soil be kept to the top, and this can easily be done if the matter be well thought over.

Artichoke, Globe.—Some suckers or young plants may be put out during the month, but this may be delayed, if necessary, until nearer spring. It is a vegetable hardly worth the growing, and one that takes up a good deal of space in the garden. Plant the suckers or young plants about 3 feet apart, and if the soil is dry they had better be well watered after planting.

Artichoke, Jerusalem.—This is quite a different vegetable to the above, and in no way related to it and, properly speaking, is not an artichoke at all. It is a native of Brazil. It is a remarkably easy vegetable to grow, and will succeed on almost any kind of soil if it be well dug and well manured with old rotten manure. Over-manuring is apt to cause the stalks to grow too rank, and then the tubers will not be so plentiful. It is an excellent vegetable, as well as a wholesome one, and it should be grown in every vegetable-garden. The tubers had better be planted as soon as they can be obtained, as they will not keep out of the ground for any length of time. Make rows about 3 feet apart, and plant the tubers along these rows about 1 foot apart, and about 5 inches deep. Cover with soil and keep free from weeds. Endeavours are being made by seedsmen in Europe to raise tubers as smooth as possible, and it is most probable their efforts will be successful.

Beans, Kidney.—These may be sown in the warmest parts of the Colony, and only in places free from frosts.

Beans, Broad.—The present month, June, is a suitable time to sow to any extent. This vegetable prefers a stiff soil, but will succeed fairly well in any soil if it be well manured. Sulphate of lime will be found to improve the quality of the beans considerably. Superphosphate of lime is also useful. Manures rich in nitrogen should be avoided.

Cabbage.—Sow a sufficient quantity of seed to meet requirements. Sow also some seed of the red or pickling cabbage, for it will be found to be useful. The pickling may be done without any difficulty. The cabbage should be cut up into fine cross-slices, and covered well with salt for about three days or more. The salt should be rubbed well into the cabbage occasionally. Then place the cut-up cabbage in pickle-jars, and pour in and cover with boiling vinegar. Allow it to cool, and then cork the bottles securely. This may be used at once. Cabbages may be planted out as required.

Endive.—Sow a little seed in the warm parts of the Colony. It is a native of a warm climate, and therefore succeeds well in warm places, although some varieties will grow well almost anywhere.

Carrot.—Sow a few rows of this useful vegetable, and thin out former sowings. The small carrots thinned out need not be thrown away, for they can be used in soups.

Leek.—This is a good, useful, and wholesome vegetable, and should be grown largely. Sow a good quantity of seed in a seed-bed. If any fair-sized seedlings are available, plant them out in very richly-manured shallow trenches. Some of the best varieties are London Flag and improved Musselburg. The trenches should be about 18 inches apart, and the young leeks should be planted deep in the soil, about 9 inches apart. The leek is a greedy feeder, and needs abundance of manure and water to bring it to the greatest perfection.

Lettuce.—Sow a little seed, and plant out strong seedlings from the seed-bed. Remove them carefully, and, if possible, without breaking their roots.

Onion.—Sow a little seed, and attend to seedlings which are coming up from former sowings. They must be kept quite free from weeds. Thin out as the plants become strong. Spread a dressing of soot and salt, half and half, about the young onions.

Parsnip.—Sow a little seed; thin out former sowings, and keep down the weeds as they grow.

Peas.—Sow largely, in rows about 3 feet apart. When the plants are about 3 or 4 inches high stick in some light brush or sticks along the rows for the peas to climb over. Be careful not to make the brush too dense and thick or the plants cannot grow. The seed should be put about 4 inches apart in drills, which should be about 3 or 4 inches deep, but not more.

Herbs.—Divide any old plants and replant.

Salad Plants, such as mustard and cress and radishes may be sown from time to time as required. Tender radishes are always useful, but all that are hard, pithy, or overgrown should be pulled up and thrown to the pigs or chickens.

Orchard Notes for June.

When the land is ready and the trees available, the planting out of new orchards may commence during the month, as the earlier in season the trees are planted the firmer and better established they will become before spring, when they start into active growth. In support of this, I may say that even during the winter the young trees are making root, and this is easily seen in nursery work, where the roots of the trees that are heeled in are often covered with young rootlets that have been formed since the trees were lifted, and which are destroyed when the tree is again removed for planting; so that had these trees been planted out permanently in the first place, instead of being heeled in and then transplanted, the root-growth made would have been available for the tree's requirements when the active tree-growth in spring makes a demand on the roots to supply the necessary moisture and food. In planting out, always take care to obtain well-grown healthy trees having a good root, and yearlings, if possible. Never plant too deep; the depth at which the tree stood in nursery is about the right depth to plant. Carefully examine the roots, and cut off any bruised or broken parts, making a sloping cut from the underside, so that the cut surface comes directly in contact with the soil, when young roots will readily start from it. Dig the holes carefully, and in planting always see that the centre of the hole is kept rather higher than the sides, so that the drainage is from and not to the main trunk of the tree. Spread the roots evenly round the hole, and spread a little of the top soil, which should be kept separate for this purpose when digging the hole, evenly round the roots, and press it firmly so that every root comes directly in contact with the soil, so that there will be no fear of the roots drying out. When planted cut the top of the tree back to the desired height; and this early cutting back has also an advantage, as the buds that are left will become much better developed during the winter than if all the top had been left on. If the tree is properly planted and cut back staking will be unnecessary, and this is always an advantage, as when staked the tree is often more or less chafed by being rubbed by the wind against the stake. If the ground is not ready the preparation of the soil should be proceeded with rapidly. Pruning should be pretty general with all deciduous trees, except the apple, which in the coast districts may not have completed shedding its leaves. I am always in favour of early pruning, as by doing so the energies of the tree are confined to the development of the buds that are left instead of being distributed over the whole. Where the orchard requires liming, it it can be done during the month, and draining where necessary should be attended to. Slowly-acting manures such as bone-meal, ground bones, or boiling-down refuse that has been composted, can be applied to the orchard during the month, and should be cultivated or lightly ploughed in, so that they may become absorbed by the soil and be rendered slowly available for plant-food when required by the trees in spring. The prunings of an orchard should always be carefully gathered up and burnt, as by this means

the spores of many injurious fungus diseases are destroyed; and whenever practicable it is of great advantage to gather up and burn all leaves that have been effected with pear mite, pear scab, apple scab, powdery mildew, or any other surface-feeding microscopic fungus, and all rotting fruit that may be left lying about and covered with the bitter rot. If this is carefully done it will be the means of destroying countless germs of disease, and will be productive of great good to the orchard. The balance of main crop of lemons should all be cut from the trees this month and properly cured, as previously described in the *Gazette*; and the earlier oranges will be ready for market, especially those from the Northern rivers, the fruit grown near Sydney being still more or less unripe and lacking sugar, though there will be a demand for a certain quantity for local consumption and intercolonial trade. Towards the end of the month, however, shipments of the ripest fruit might be prepared for export; but the fruit will have to be of extra quality and well packed. After undergoing a week's curing to toughen the skin, all fruit for export should be carefully wrapped and evenly and lightly packed, and all blemished fruit—no matter how small the blemish may be—should be rigidly excluded.

Our fruitgrowers have had a very good opportunity during the present autumn of seeing how fruit should be got up and packed for export, by means of the cases of Sicilian lemons which have been exposed in our market for sale; and it is to be hoped that they will take a lesson from the Sicilians, for if there is one thing our growers are deficient in above all others—and their faults are not few—it is in the handling, packing, and marketing of their fruit.

General Notes.

The Soils of the Labour Settlements.

The suitability of the soils of the Pitt Town and Wilberforce Co-operative Settlements having been brought into prominence in the metropolitan press, the following analyses by the Departmental Chemist, Mr. F. B. Guthrie, will doubtless prove of interest to readers generally, as well as valuable as a guide to the settlers in cultivating the areas of which they are typical.

Pitt Town.

The soil is a sandy loam, having a capacity for water of 32 per cent., and an absolute weight per acre, 6 inches deep, of 2,562,206 lb. A mechanical analysis shows that it contains of root fibres, ·20 per cent.; stones over ¼ inch in diameter, ·41 per cent.; coarse gravel more than $\frac{1}{16}$ inch in diameter, 6·35 per cent.; fine gravel more than $\frac{1}{50}$ inch in diameter, 7·91 per cent.; fine soil, 85·13 per cent., comprising sand, 45·68 per cent., and impalpable matter, chiefly clay, 39·45 per cent. An analysis of the fine soil discloses moisture, 1·742 per cent., and volatile and combustible matter, principally organic, 5·107 per cent. The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of lime, ·093 per cent., the general value of which is fair; potash, ·112 per cent, general value satisfactory; phosphoric acid, ·053 per cent, general value fair; nitrogen, ·188 per cent. (equal to ammonia, ·204 per cent.), general value satisfactory; ferrous oxide, ·180 per cent.

In his general remarks Mr. Guthrie says: "This analysis is made on samples 7 and 8 mixed together, as being typical of the largest area. The soil, though not particularly rich, is not deficient in fertilising materials, is in fair mechanical condition, and does not contain any injurious ingredients It would benefit by draining and the addition of lime; about ½ ton per acre would improve it. Good farmyard manure would probably be sufficient for most crops, with additions in the way of special fertilizers for special crops; about 4 cwt. of bone-dust per acre for maize, hay, and vegetables."

Wilberforce.

This settlement forms a portion of Wilberforce Common, the soil being a sandy loam, having a capacity for water of 29·6 per cent., and an absolute weight per acre, 6 inches deep, of 3,008,118 lb. A mechanical analysis shows that it contains of root fibres, ·14 per cent.; stones over ¼ inch in diameter, ·00 per cent.; coarse gravel more than $\frac{1}{16}$ inch in diameter, ·00 per cent.; fine gravel more than $\frac{1}{50}$ inch in diameter, ·62 per cent.; fine soil, 99·24 per cent., comprising sand, 72·02 per cent., and impalpable matter, chiefly clay,

27·22 per cent. An analysis of the fine soil discloses moisture, 1·019 per cent.; volatile and combustible matter, principally organic, ·110 per cent. The fertilising substances, soluble in hot hydrochloric acid of 1·1 specific gravity, consist of lime, ·112 per cent., general value satisfactory; potash, ·003 per cent., general value bad; phosphoric acid, ·043 per cent., general value indifferent; nitrogen, ·077 per cent. (equal to ammonia, ·093 per cent.), general value fair; ferrous oxide, ·216 per cent.

In his general remarks Mr. Guthrie says: "The analysis was conducted on No. 2, which appears typical of the largest area. This is a poor soil, inclined to be sour, and would require draining, liming, and liberal dressings of manure before the best results are obtainable. It is in fair mechanical condition. For special crops, especially roots and grain, it will require the addition of manures containing phosphoric acid and potash. Speaking generally, plenty of bone-dust and about 2 cwt. of kainit per acre will benefit it considerably. The almost total absence of potash is quite remarkable."

A Prolific Wheat.

In response to an inquiry by Messrs. Haywood Bros., of Pambula, the Department recommended the growth of Galland's Hybrid wheat for poultry-feed, both on account of its rust-resisting qualities and its prolificness. The following letter, dated 12th March, 1894, has been received from Messrs. Haywood:—"You will remember we wrote for particulars and information last May regarding the most suitable varieties of rust-resisting wheat to grow for poultry-feed. In reply, Galland's Hybrid was mentioned in particular. Your Department sent us shortly afterward half a bushel of the above-named wheat, which was carefully sown, on the 30th May following, on a rich piece of alluvial land adjoining the Pambula River, about one-fifth of an acre in extent. Before sowing we calculated that at least one-third of the wheat was destroyed by weevil; so we planted it a little thicker. However, it came up very thin—certainly not half as thick as it should be for a crop. It stooled out well, and grew rapidly to a height of 6 feet, and was harvested the first week in January last, when it could be easily seen that there was ample room for twice the crop on the same piece of land. The season was unusually wet from the time of sowing up to the time it was reaped, and not a sign of rust could be noticed. From one-fifth of an acre we have just threshed 8 bushels of seed, and we intend sowing the whole of it for seed purposes. We may state that we have never grown such a wonderfully prolific cereal excepting maize. Its large ears of heavy grain hang down almost half way to the ground. The straw was used for thatch. As we have gone into poultry and egg farming this variety of wheat will certainly be of the greatest value to us, because of its rust-resisting qualities and its prolificness. No farmer should be without a few acres."

Reference is made to this variety of wheat in Vol. IV, p. 468, where it is stated:—"Galland's Hybrid is an enormously prolific, hardy, rust-resistant, mid-season or somewhat late variety. It has been known to yield 90 bushels to the acre. The grain is very inferior for flour, and is used for fowls. In appearance this variety resembles Algerian, and to a less extent the larger Durums, such as Xeres. It is grown in many parts, but not extensively. It will flourish on poor soil, and with little attention."

The Prevention of Phylloxera.

In a communication addressed recently to the *Sydney Morning Herald*, Mr. Henry Bonnard, of Vitis Park, near Richmond, urges upon vine-growers the necessity for treating their vines during the winter with the following mixture, recommended by "The High Commission against Phylloxera" in France, as a means of destroying the winter egg. The mixture for 1,000 vines is prepared by dissolving in 50 or 60 gallons of water 25 to 30 lb. of sulphate of iron, to which may be added a few pounds of sulphuric acid, or better, a few pounds of sulphuret of potash. Then wash, or mop carefully, the whole of the old wood of every vine below the wood of the year with a paint or whitewash brush. The wood will soon look as black as if charred, and as the solution will damage the linen, clothing, and boots of the operator, he should not wear his best suit for the occasion.

In a report on the above-mentioned communication, Mr. J. A. Despeissis, Consulting Viticulturist to the Department, says:—"The solution is the same which has been for a couple of years or more recommended by the Department as a preventive against anthracnose or black spot on the grapes, and I have no doubt that if brought into contact with the phylloxera, its winter egg, or any spores or parasite on the vine, it would destroy them speedily.

"In this matter, however, united and wide-spread action would be required, and the application would have to be very thorough, and extend to the old wood and the whole of the stem, instead of being confined, as in the case of anthracnose, to the younger wood of the previous year.

"This treatment, if not an absolute guarantee of the destruction of the phylloxera on the vine, would, however, be productive of much good in many respects. It is cheap, would save the crop from the attack of anthracnose; would destroy a considerable number of the spores of the oïdium, as well as larvæ of insects destructive of the vine, and also annihilate, by contact, the winged form of the phylloxera, or its egg, and would bring each stock of vine more directly under the notice of vine-growers and vine-dressers, who would thus be better able to notice at the start any possible invasion of the vine by the pest, and thus take prompt measures to stop its further encroachments."

AGRICULTURAL SOCIETIES SHOWS, 1894.

Society.	Secretary.	Date.
Dapto A. and H. Society	A. B. Chippindale	Jan. 9, 10.
Clunes Agricultural Society	J. W. Brown	„ 17, 18.
Albion Park A. and H. Association	T. Armstrong	„ 17, 18.
Kiama A. and H. Association	J. Somerville	„ 25, 26.
Holt-Sutherland H. and I. Society	W. Douglas	„ 26.
Wollongong A. and H. Association	A. J. A. Beatson	„ 31, and Feb. 1
Berry A. and H. Society	A. J. Colley	Feb. 6, 7, 8.
Gosford A. H. and I. Association	H. S. Bevrendge	„ 9, 10.
Luddenham A. and H. Association	K. Campbell	„ 13, 14.
Manning River (Taree) A. and H. Association	W. Plummer	„ 14, 15.
Lithgow A. and H. Society	M. Asher	„ 15, 16.
Shoalhaven (Nowra) A. and H. Association	R. Leeming	„ 15, 16.
Marulan P. and H. Society	H. Morrice	„ 23.
Kangaroo Valley A. and H. Society	H. Joyce	„ 25, 26.
Candelo A. and H. Association	C. H. Brooks	„ 27, 28.
Tumut A. and P. Association	W. H. Bridle	„ 27, 28.
Tenterfield P., A., M., and H. Society	J. Harker	„ 27, 28, and Mar. 1.
Port Macquarie A. and H. Society	A. E. Poutney	„ 28 and Mar. 1.
Lismore A. and H. Society	C. S. Connor	„ 28 and Mar. 1, 2.
Berrima District (Moss Vale) A., H., and I. Society	J. Yeo	Mar. 1, 2, 3.
Nepean District (Penrith) A., H., and I. Society	R. Benaud	„ 1, 2, 3.
Robertson Agricultural Society	R. J. Ferguson	„ 6, 7.
Uralla P. and A. Association	J. D. Leece	„ 6, 7.
Bega A. and P. Association	A. J. Wilson	„ 7, 8.
Inverell P. and A. Association	J. M'Ilveen	„ 8, 9.
Picton Agricultural Society	G. Bradbury	„ 8, 9.
Cobargo A. and P. Society	J. Graham	„ 13, 14.
Tumberumba P. and A. Society	W. Willans	„ 13, 14.
Glen Innes P., A., and M. Association	J. Denshire	„ 14, 15.
Goulburn Agricultural Society	J. J. Roberts	„ 15, 16.
Gulgong Agricultural Association	S. Turner	„ 16, 17.
Armidale (Combined Show), A. and P. Association	W. H. Allingham	„ 20, 21, 22.
Taralga A. and P. Association	J. J. Walsh	„ 21, 22.
Royal Agricultural Society (Sydney)	F. Webster	„ 21 to 27.
Braidwood P. and A. Association	G. F. Taylor	„ 22, 23.
Castle Hill A. and H. Association	F. H. G. Rogers	„ 26, 27.
Orange A. and P. Association	J. S. Thomas	„ 28, 29.
Walcha P. and A. Association	H. Chapman	April 4, 5.
Lower Clarence (Maclean) Agricultural Society	J. S. Dunnet	„ 4, 5.
Camden A., H., and I. Society	W. R. Cowper	„ 4, 5.
Gundagai P. and A. Society	W. E. Kyle	„ 5, 6.
Blayney P. and A. Association	G. H. Woolly	„ 5, 6.
Gundaroo P., A., and H. Association	J. Affleck	„ 6.
Namoi (Narrabri) P., A., and H. Association	J. Riddle	„ 11, 12.
Bathurst A., H., and P. Association	W. G. Thompson	„ 11, 12, 13.
Clarence (Grafton) P. and A. Society	T. Page	„ 18, 19.

Society.	Secretary.	Date
Wellington P. and A. Association	R. Porter ..	April 18, 19.
Hunter River (West Maitland) A. and H. Association	W. C. Quinton ...	,, 18, 19, 20.
Dubbo P., A., and H. Association...	G. H. Taylor ...	,, 24, 25, 26.
Warialda P. and A. Association	W. B. Giddes ...	,, 25, 26.
Mudgee Agricultural Society	J. M. Cox ...	,, 26, 27.
Macleay (Kempsey) A. and H. Association ...	H. R. Gray ...	May 9, 10, 11.
Gwydir (Moree) P. and A. Association	J. G. Cohen ...	,, 9, 10.
Upper Hunter (Muswellbrook) A. and H. Association	Price Healey ...	,, 16, 17.
Upper Manning (Wingham) A. and H. Society...	J. J. Herkes ...	,, 16, 17, 18.
Hornsby, Thornleigh, Pennant Hills, &c., H. Association	H. Epthorp ...	,, 23, 24.
Cumnock P. and A. Association	W. Newmarch ...	,, 24.
Warren P. Association	F. C. Thompson ...	June 7, 8.
Cobar P. and A. Association	A. Roxburgh ...	,, 13, 14.
Riverina (Jerilderie) P. and A. Society	J. Fulton... ...	July 24, 25.
Forbes P., A., and H. Association...	W. G. Dowling ...	Aug. 9, 10.
Northern (Singleton) Agricultural Association ...	C. Poppenhagen ...	,, 15, 16.
Cowra P., A., and H. Association...	S. Wright... ...	Sept. 5, 6.
Burrowa P., A., and H. Association	J. F. Clifford ...	,, 13, 14.

Secretaries of Societies are asked to forward dates of forthcoming Shows as soon as decided.

[4 plates.]

Sydney: Charles Potter, Government Printer.—1894.

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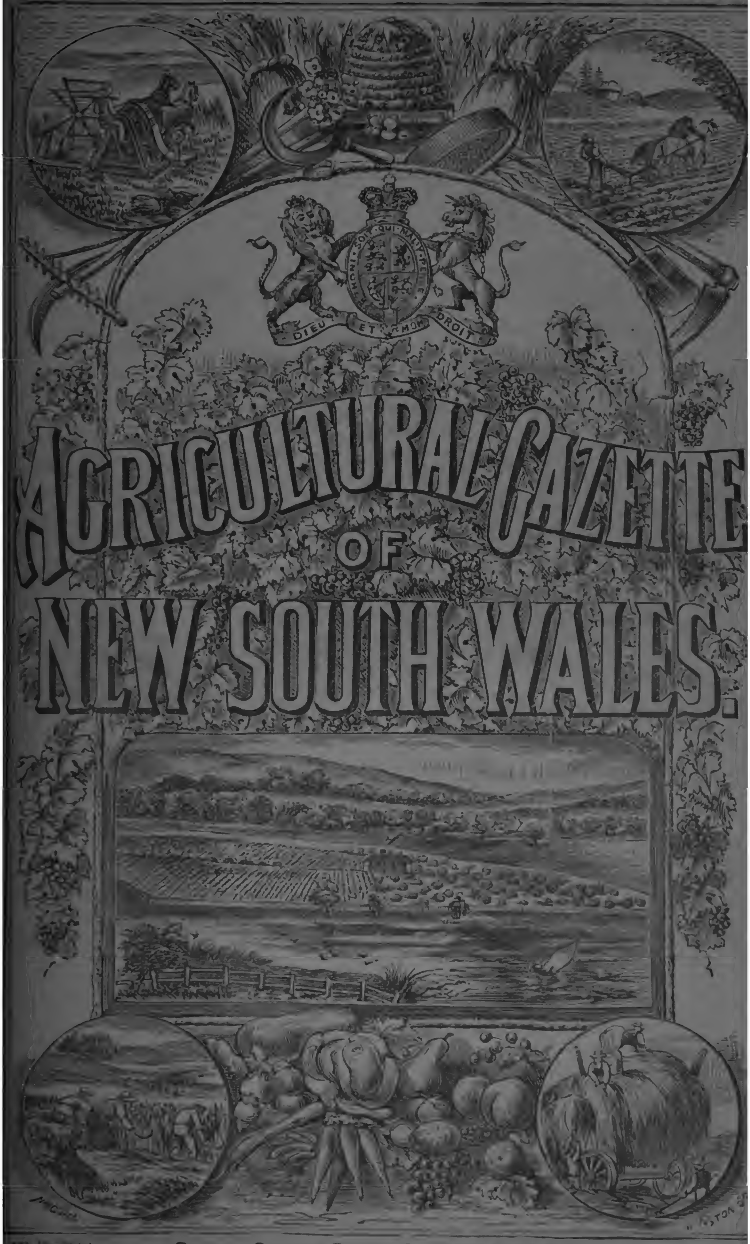


AGRICULTURAL GAZETTE OF NEW SOUTH WALES.

SYDNEY: CHARLES POTTER, GOVERNMENT PRINTER.

SEE PAGE INSIDE OF WRAPPER.

Hierochloa rariflora, Hook. f.

"A Scented Grass."

(11659-94)

Useful Australian Plants.

By J. H. MAIDEN,
Consulting Botanist.

No. 11. A Scented Grass.

(*Hierochloa rariflora*, Hook. f.)

This is one of the very few grasses of New South Wales which are sought after as perfumes rather than as fodder-plants. In fact, it is the perfume-grass *par excellence* of this Colony, and it is so often brought to Sydney as a curiosity, that it is well to examine into it. By reputation, at least, it is a very well-known grass, but most people have but a nodding acquaintance with it.

It belongs to the genus *Hierochloa*, which comprises from eight to thirteen species, according to the views of different botanists. Bentham describes it as "an Arctic and Antarctic genus common to the New and Old World, extending into more temperate regions in Europe, South Africa, the Himalayas, and Mexican mountains." We have two species of *Hierochloa* in New South Wales, viz., *H. redolens*, and *H. rariflora.* They are very nearly related, but as, in my experience, the latter is more commonly met with in this Colony, I have chosen it first for description.

Vernacular Names.—Usually known as "Scented Grass," but sometimes also as "wire grass," for obvious reasons.

Botanical Name.—Hierochloa or *Hierochloe*, from two Greek words, *hieros*, holy; *chloe*, grass. It is generally and properly spelt *Hierochloa*, but Gmelin, the author of the genus, wrote it *Hierochloe. Rariflora*, from two Latin words signifying thin or loose (inflorescence), in allusion to the panicle. The word *rarus* is the opposite of the word *densus*, which signifies dense.

Botanical description.—I think it will be a convenience to many to have a description of the genus preceding the detailed description of the species. If other species of the same genus be subsequently described, the description of the genus will not be repeated.

Genus *Hierochloa* (*Flora Australiensis*, Vol. VII, p. 559).

Spikelets with one terminal hermaphrodite flower and two male flowers below it, in a pyramidal or narrow terminal panicle, the rachis articulate above the two outer glumes.

Glumes 6, thinly scarious, *two outer* acute-keeled with a more or less distinct short nerve on each side. *Third and fourth* obtuse or emarginate, the keel sometimes produced into a short awn, each enclosing a narrow palea and three stamens; *fifth*, shorter, broad, obtuse, five-nerved, the keel rarely produced into a short point, enveloping the *sixth*, which is narrower with a central nerve or keel. No two-nerved palea to the terminal flower.

Stamens—Two.

Styles—Distinct.

Grain—Enclosed in the two upper glumes.

H. rariflora.

Stems.—Slender, branching, 2 to 3 feet high.
Leaves.—Narrower than in *H. redolens*, tapering into long subulate points.
Panicle.—Loose and spreading, 2 to 3 inches long.
Spikelets.—All on slender pedicels, often variegated from the contrast of the purplish outer glumes and pale-coloured upper ones.
Glumes.—*Outer persistent glumes* broad, obtuse, the lowest about 1½ lines long, the second rather large and three-nerved; *intermediate male glumes* about two lines long, rather rigid, five-nerved, obtuse, and awnless, finely and shortly ciliate on the margins, and sometimes on the keel.
Fifth glume.—Very broad, thin, obtuse, glabrous, five-nerved.
Sixth glume.—Much narrower, keeled, but the lateral nerves scarcely visible.

Dr. (now Sir Joseph) Hooker, who first described this grass from a Tasmanian specimen, speaks of it as "a very distinct species, conspicuous for its slender, branched, leafy, knotted culms, 2 to 3 feet long, its narrow, strict rigid leaves rough to the touch, and small loose panicles of small spikelets on long flexuous branches." This is a brief popular description which could not readily be improved upon.

Size and habit.—Two to three feet, and even more, in exceptional instances. Not erect, but wiry and straggling.

Relative abundance.—While it is not rare in the cold moist, mountainous, regions of the south-east of the Colony, it does not appear to be an abundant grass in any locality.

Value as fodder.—We have practically no data as to the specific fodder-value of our scented grass, and therefore we must fall back upon comparisons with other grasses belonging to the same genus. All *Hierochloas* have a certain value as sweeteners of musty or other hay, the pleasant odour they impart being grateful to most herbivorous animals. But I express the opinion at once that our scented grass is of no agricultural importance. It is true that it is probably fairly nutritious, but its foliage is sparse, the whole plant is wiry, the seed is less abundant than in the other Australian (and in most other) species; and, supposing for a moment that anyone in the Colony thinks of propagating it, the warning of Mr. Fletcher, of Canada, as to the tendency of a closely-related species to become (in Manitoba) a noxious weed, should be borne in mind.

Speaking of a native *Hierochloa*, Mr. Bacchus states, "I am aware that stock eat the grass, but know nothing of its merits for grazing."

Baron von Mueller (*Select Extra-tropical Plants*) recommends the Australian *H. redolens* as worthy of dissemination on moist pasture land, and recommends *Hierochloas* in general as particularly appropriate for cold wet, moory grounds.

We will now inquire what is the opinion held in regard to *Hierochloas* in older countries.

Under the name of *Holcus odoratus*, there are some interesting notes on *Hierochloe borealis* in Sinclair's *Hortus Gramineus Woburnensis* (2nd Ed., p. 167). There are some data as to the product per acre of this grass, dried and green, and at different seasons. Mr. Sinclair proceeds, "Though this is one of the earliest flowering grasses, it is tender, and the spring produce of herbage is very inconsiderable, the flowering straws rising up in a manner destitute of leaves. This deficiency of produce is much to be regretted, as the nutritive qualities of the grass are greater than in most of the early spring grasses; it sends forth but a few flower straws, which are of a slender structure, compared with the size of the leaves. In no instance that I have observed was this grass eaten by the hares and rabbits which

preyed upon many of the other grasses. The powerful creeping roots of this grass, its tender nature, and the great deficiency of foliage in the spring, are demerits which discourage the idea of recommending it further to the notice of the agriculturist."

H. borealis is dedicated to the Virgin Mary on account of its sweetness, and is strewn about Catholic Churches in Northern Europe on festival days. Hence the name Holy Grass. The odour it emits is much more powerful when it is trampled upon. It is often called Vanilla Grass on account of its perfume. This is the grass stated by Don to be indigenous to Scotland, as well as to Sweden, Norway, &c. No one else found it in Scotland, and it was dropped out of lists, until Robert Dick, the baker botanist and geologist of Thurso, rediscovered it in that country, and an account of the discovery is pleasantly recounted by Samuel Smiles in his life of that worthy.

Hierochloa borealis is common along the streams and rivers in the mountainous districts of Montana, U.S.A., frequently occupying extensive areas to the exclusion of all other grasses.—(Prof. Scribner, quoted by Dr. Vasey.) Dr. Vasey says that this grass is known in the United States as Vanilla or Seneca grass, and Holy Grass. "It is a perennial grass of northern latitudes, growing in moist meadows near the coast, also in low marshy ground in some parts of Illinois and other States bordering the great lakes, and in the mountains of Colorado and northward. . . . In our country it does not appear to be adapted to general cultivation."

According to Mr. James Fletcher (*Bulletin* No. 19, *Central Experimental Farm, Ottawa*), this grass is known in Canada as Indian Hay, and he makes the following observations in regard to it:—"When cut or fed off, it keeps continually producing young leaves. When once established, however, it is very peristent, and in Manitoba is rapidly becoming a noxious weed most difficult to eradicate. It cannot, therefore, in any case be recommended for cultivation there, and should be introduced everywhere with caution. Our analyses prove it to be a very rich grass. Horses and cattle eat it readily.

"This is the grass of which the leaves are used by the Indian women to weave the scented 'Indian hay' baskets and mats."

No analysis of our scented grass has yet been made. It will therefore be useful to peruse the two accompanying analyses of *H. borealis.* No. 1 is a Canadian grass, gathered with the seeds half ripe. No. 2 is from the United States. It will be observed that the Canadian specimen was very moist. The albuminoids (the flesh-forming constituents of plants) are unusually high.

	In Fresh or Green Material.						Calculated to Water-free Substance				
	Water.	Ash.	Albuminoids.	Fibre.	Nitrogen—Free Extract.	Ether Extract (Fat).	Ash.	Albuminoids.	Fibre.	Nitrogen—Free Extract.	Ether Extract (Fat).
No. 1 ...	75·32	1·64	4·93	6·14	10·68	1·29	6·63	20·00	43·25	24·88	5·24
No. 2 ...	14·30	7·99	12·12	19·73	43·28	3·48	9·32	14·15	23·02	49·45	4·06

Other uses.—None, except that there would be a limited sale for small baskets and other plaited work made out of it.

Coumarin. — Our grass, in common with the closely-related *Anthoxanthum odoratum* (Sweet-scented Vernal Grass), owes its pleasant odour,—the fragrance of new-mown hay in fact,—to the presence of an aromatic body called *Coumarin.* Coumarin is contained in Tonka Beans to a large extent, in the bark of Coachwood (*Ceratopetalum apetalum*), and other trees; in Melilot (*Melilotus*) of various species, Woodruff (*Asperula odorata*), certain *Adiantums* (Maiden-hair ferns), and other plants too numerous to particularise. It is therefore desirable to have a few particulars as to what Coumarin is. It consists of white silky crystals (needles), whose chemical composition is represented by the formula $C_9H_6O_2$. It is remarkable that in most plants that contain it, the Coumarin is only developed, at all events in quantity, after the plant ceases to grow. For instance, Tonquin Beans are nearly inodorous when growing on the tree, while our *Hierochloe* develops far more Coumarin when made into hay than when growing.

Habitat and range.—It is endemic in Australia (New South Wales, Victoria, and Tasmania). In the *Flora Australiensis*, the New South Wales locality given is Twofold Bay. I have received it from Mount Substitute, near Bombala, from Cooma, and other localities in the Monaro, where it is by no means rare; also from the Dromedary Mountain, the Sugarloaf Mountain, near Braidwood, and Bolaro Mountain, near Nelligen, which is the most northerly locality for it up to the present. I should not be surprised if this grass were eventually found in the highest parts of the New England ranges.

Reference to plate.—A, barbed appearance of the margins of the leaves, causing them to be rough to the touch; B, spikelet, showing two male flowers at the side, and one hemaphrodite flower in the middle and above the other two; C, a male flower; D, hemaphrodite flower; E, grain or seed. All variously magnified.

Colonial Timbers for Wine-Casks.

By J. H. MAIDEN.

I DRAW attention, in a tentative way, to the subject of indigenous timbers for cask (and particularly wine-cask) making. The subject is not free from difficulty, for in Europe the best woods for casks have only been found out as the result of many experiments and long experience. Ours is a new country, and we cannot gain experience in a moment; moreover, money is not sufficiently plentiful to enable one to risk the quality of a large quantity of wine in trying experiments on many timbers. But with our admittedly wonderful variety of native timbers, it would be a most extraordinary thing if we have not among them some timbers which satisfy all the desiderata of a good wine-cask. I would go further, and say that such a thing must be impossible. So much being premised, we want to find the best timbers for the purpose. I proceed to give a few notes in regard to timbers most of which have been more or less tested for wine-cask making. I hope it may be suggestive, and that it may result in the Department being furnished with hints on the subject by vignerons, coopers, and others. The Department is only too anxious to aid the important wine industry of the Colony, in helping those engaged in it in regard to this very important question. There ought to be no insuperable difficulty in having small casks made of various woods, and wine placed in such casks, to be examined by experts in the subject.

Mr. Hubert de Castella, the well-known Victorian vigneron, in giving evidence before the Vegetable Products Commission of that Colony states, "I do not think lightwood is a very good wood for casks; it gives a slight taste; I tried lightwood; I had thirteen large casks made from lightwood, and we exchanged them for oak. Even after a year or two, and wine had been in it, we thought it gave a slight taste to the wine—an oily taste."

Subsequently, Mr. de Castella said, "On a former occasion I made a few remarks on casks, a subject which is of the greatest importance to the wine industry of this country. I was in hope that this might have provoked some discussion, but in this I have been disappointed; and now again I venture to urge the importance of the matter............I have used blackwood since 1863, and found it in every respect equal to oak. By blackwood I do not mean what is often supposed to be the same, namely lightwood, which is utterly unsuitable for wine, though good enough for tallow..............Mr. Ransome, one of the judges of Australian timbers at the last London Exhibition, recommended mountain ash as suitable for cooperage; and I have been told that this wood is largely used at Albury. There again a vast difference must be made in favour of what is called blackbutt, which is quite different timber from the mountain ash, as between blackwood and lightwood............When I first began to make the casks, oak was the only timber supposed to be used. There was not a plank of oak in all the

Colonies. Mr. Higginbotham was making railway carriages and he said 'Why not use blackwood, as we do in the Railway-works?' and I got a couple of planks and made a cask of 130 gallons, and I made big casks, 1,500-gallon casks, and it is an excellent wood. And then the mountain ash has to be tried. There is some prejudice against those things. In England some people say they will not have the wine in any cask except Baltic oak............I asked when I was buying staves, whether there was any difference between blackwood and lightwood, and the timber-merchant showed me that if you crosscut the wood, the blackwood is as hard as horn, and the lightwood porous. As the cooper puts his mouth to it his breath comes through. The one is useless for wine and the other is excellent, but the coopers do not know that generally."

As regards the blackwood and the lightwood of which Mr. de Castella speaks, I would invite my readers to the article on blackwood in the *Gazette* for March, page 129, where the subject is discussed, so that I need not repeat myself here.

Speaking of mountain ash, Mr. H. de Castella says, "I have tried to put new wine in mountain ash, which is a very good wood; it has not given any taste to the wine, except that those casks being made by a cooper who bent the staves with fire, the mountain ash, from being charcoaled a little inside, gave a slight taste."

Mr. de Castella speaks highly of mountain ash, and even more highly of blackbutt. Now the mountain ash is probably that very tall Victorian tree which is botanically ranked under *Eucalyptus amygdalina.* This is best known as an oil-yielding species; but it may be *Eucalyptus Sieberiana,* which is well known in New South Wales as a mountain ash. It has a bark which at a little distance may be mistaken for an ironbark, but the branches are, unlike those of ironbarks, perfectly smooth. It is common in cold mountain regions, chiefly in the southern coastal districts. Whether this is the mountain ash referred to by Mr. de Castella or not, it is a grand timber, pale coloured, an excellent splitter, and a sound, durable, strong timber. I would strongly recommend that it be given a thorough trial for wine-cask making.

Again, it may be a mountain ash sometimes known as white ash which is found in the highest mountain ranges in the direction of Candelo to Kiandra, and the extreme southern portion of the Colony generally. This is a beautifully clear, straight-grained, white timber, which is at present brought to Sydney in small quantities as a substitute for American ash, and it is used to some extent for bed-room furniture. At present it costs a good deal for carriage, but it is a first-class timber, and is, I should think, likely to be eminently suitable for wine casks. If the matter be inquired into I have no doubt we shall find this timber in more accessible localities.

As regards the blackbutt, if Mr. de Castella is reported aright, it must be our old Sydney friend *Eucalyptus pilularis.* But if you want to see really fine blackbutts go to Termeil, between Ulladulla and Bateman's Bay, and other localities on the South Coast. There you will find very giants, both as regards height and girth, and they will split as straight and as true as good stringybark.

But, to return to Mr. de Castella's evidence, it is not perfectly clear, because of the use of vernacular names. I have shown that there are various mountain ashes, and when he speaks of blackbutt, it is quite possible that he is speaking of a very black-butted mountain ash, such as *Eucalyptus Sieberiana,* in comparison with the smooth barked mountain ash known to botanists as *Eucalyptus amygdalina.* When the use of vernacular

names (particularly in regard to Eucalypts), causes a feeling of uncertainty as to the timber referred to, is it a wonder that botanists look forward to the millennium, when everybody will use botanical terms for the purpose of designating timbers, because the advantages of their use are so evident? That botanical names are hard to get hold of is a popular error, as erroneous as it is widespread.

Mr. William Graham, also giving evidence before the Victorian Royal Commission on Vegetable Products, says: "The native woods seem to be very good for wine casks, but we have not tried them to any extent. I think blackwood is the best colonial wood for casks. Mountain ash has been used, and has been fairly successful, but not to any great extent. Casks from Tasmanian silver wattle look very well."

It will be observed that both Mr. de Castella and Mr. Graham appear to think that blackwood is the best colonial timber for wine casks. Small blame to them, for they are Victorians, addressing a Victorian Royal Commission, and blackwood is a common timber far better known in Victoria than in this Colony. We have a far better assortment of timbers than our good friends over the Murray, and surely we do not lack the enterprise necessary for taking advantage of our good fortune.

Mr. Graham cautiously refers to casks of Tasmanian "Silver Wattle" as *looking* very well. I am afraid we want something else in wine-casks than good looks; but if anyone in New South Wales wishes to try silver wattle we have plenty of it. Its botanical name is *Acacia dealbata*. Other New South Wales wattles I would like to draw attention to in this connection are the black wattle with broad, two-veined leaves (phyllodia), whose botanical name is *Acacia binervata*. It is plentiful in the coast districts, grows to a large size, and the mature wood is dense. Then we have the mountain hickory, which is abundant in the mountainous districts of the South. It attains a large size and its timber is an excellent substitute for the true blackwood. Its botanical name is *Acacia peninervis*. Then I would doubtfully suggest the brigalow (*Acacia harpophylla*) of which a good deal is to be found in the Narrabri District. It is a dense, valuable timber and might be tested by the wine-growers along the Northern line of railway.

Perhaps the New South Wales timber which has been spoken of more than any other for wine-casks is the silky oak (*Grevillea robusta*), which grows in the northern brush forests. At one time it was far more extensively used for tallow-casks than it is now, but a number of experiments have been made with the view to give it the more dignified employment of wine-storage. Mr. Thomas Hardy of South Australia placed shavings of this wood in light wines for two months without affecting the taste and colour of the latter. He pronounced the wood suitable in other respects, and therefore suitable for casking wine. The opinion of an authority so eminent must carry great weight, and I am therefore surprised that I have not heard of the matter being followed up during the last three or four years. Silky oak would not leak when split on the quarter, and Mr. Hardy has been instituting inquiries as to whether the staves would leak when the wood was cut across the grain. I have not heard the result of these inquiries. Mr. Charles Moore, Director of the Botanic Gardens, pronounces silky oak too porous to hold such liquids as spirits.

Now that *Grevillea robusta* is getting scarce, I would like to draw public attention to what I believe to be a perfect substitute for it. The commonest tree in the Dorrigo Forest Reserve is one known to botanists as *Orites excelsa*, and its wood usually passes as silky oak. I examined the timber carefully in the forest, and brought a few pieces to Sydney. Everybody I have shown

them to pronounces them to be silky oak. At the present time, if there is any difference between this *Orites excelsa* timber and that of *Grevillea robusta*, I do not know what it is, and it is evidently not of a superficial character. I was pleased to make this discovery, as there is a perfect mine of this silky oak in the Dorrigo. There are millions upon millions of feet of it, and at present not a stick is used. But even if it be not used for wine-casks the time will come when it will be used for butter or tallow-casks, or for some other humbler yet useful purpose.

I desire now to draw attention to a timber for wine-casks which I had not thought of for the purpose until Mr. Thomas Bawden, of Grafton, kindly brought it under my notice. His remarks on such a subject demand respect, for, as is well known, he has given a good deal of attention to the utilisation of our native products during the last thirty years and more. Mr. Bawden says, "With regard to wine-casks, and the proper wood for the purpose, I think you will find rosewood the very best. I know some years ago the late Richard Bligh had some large vats and casks made of that timber, which suited admirably, and certainly gave no taste to the wine. I yesterday asked an old wine-grower of large experience what he thought best for wine-vats or casks, and he at once selected rosewood, as giving no taste of a deleterious character to the wine. He has tried silky oak, but has condemned it, and has not been able to get anything better than rosewood." I replied expressing doubt that an odorous wood, of the nature of rosewood, would not affect the bouquet of wines stored in it. In a recent letter Mr. Bawden writes,—"With regard to the rosewood for casks, I have the assurance, in addition to my own large experience, of one who has been engaged in wine-making in this district for the past thirty years, that the wood does not give any taste to the wine. Might I suggest an experiment of a small piece of seasoned rosewood placed in a bottle of wine for a few months? Should the rosewood turn out as I believe it will, there are large quantities of it in this district." I venture to express the hope that those who have tried rosewood for wine-casks will relate their experience, and that those will test it who have facilities for so doing and have not yet done so. It is high time that such an important matter were settled. The botanical name of the rosewood referred to is *Dysoxylon Fraserianum*, and I should also like to see exhaustive tests made of the red bean (*D. Muelleri*) which may be described as a scentless rosewood. Who will take the matter up? In the Dorrigo Forest Reserve (not to mention other northern forests) there is an enormous quantity of mature rosewood, and at the present time an axe is never put in it. Just now things are so bad with the unfortunate timber getters, that rosewood may be had at a very low rate. It behoves patriotic people to do their level best to encourage the use of colonial timbers. At present a timber is looked askance at, in many quarters, simply because it is colonial. But this should not be. Surely an educated public is discriminating enough to know a good timber and value it on its merits.

This article is already of sufficient length, and I will therefore content myself by alluding to only one more timber. I have heard native beech (*Gmelina Leichhardtii*) spoken of in the highest terms as an excellent timber for wine-vats. Is there any drawback to its use? If so, what is it?

And if all these timbers I have mentioned be found unsuitable for wine-casks, I will mention some more, for if public spirited men can be found to thoroughly test the timbers, I am determined that they shall not lack likely woods to experiment upon.

Our Timber Trees and Forest Culture.

By W. MacDONALD,
Forester.

Introductory.

My paper is compiled partly from my own practical experience and observation, and partly from the better experience and scientific researches of others. I now submit in the hope that it may, at least, prove readable to those who take an interest in forestry and arboriculture.

Destruction of Timber.

In view of our present abundant supply of timber we often lose sight of the future, but let us consider our present output and fast increasing demands, combined with the enormous quantity of timber which is being destroyed by ringbarking and the clearing of land, and that which is ruthlessly destroyed throughout the Country, of this we can form no estimate, but if complete statistics could be compiled some startling facts would be disclosed. What we daily observe in our own immediate surroundings affords us ample proof that no natural growth can possibly keep pace with the axe and present disastrous warfare of extermination, and under such circumstances it cannot be considered premature to advocate

Forest Conservancy.

Not only should our native forests be thinned out, cleared of useless timber and deadwood, and annually maintained in various eligible sites throughout the country, but I am of opinion that it should be imperative on the part of individual landowners, and more particularly those of large estates, to have their own plantations in conformity with the area and adaptability of each respective holding, such plantations to be amenable to forest laws, under the supreme surveillance of the State.

It may be argued that a man should have the privilege of doing what he pleases with his own land, and that such a law as I advocate would be too great an interference with the rights and privileges of free men in a free country. Such an argument may be all very well in individual interests, but will certainly not stand for a moment from a national point of view. A law compelling us to plant a few gum-trees and cedar-trees on our land would be no more arbitrary than our existing law which binds us to eradicate certain noxious weeds.

The planting of trees and shrubs may well be considered one of the most interesting and important of rural industries, and one which is becoming a subject of great national importance.

Forests exercise great influence on the climate and on the health and death-rate of a country.

The planter obeys the dictates of reason, and justly provides for his descendants. He improves the value of his estate, and in the performance of his duty he enjoys an innocent and healthy recreation. These considerations apply with equal force to the Government, and present a problem easy of solution. Let us then try to realise the grave importance of the case: the increased value that might be given to unalienated lands, private estates, roadsides, streets, &c., by the planting of the most suitable kinds of trees. How glorious would be the result of united and well-directed efforts, more especially on the dry plains of the interior, where in the summer time the weary traveller welcomes a solitary gum-tree as an oasis in the desert. Even on the smallest farms a few forest trees and shrubs in the hedges and corners of the paddocks would impart a dignity to the spot. A house, however beautifully built, standing alone without a sheltering tree, is a cheerless object of a landscape; even a bark hut, surrounded by a few ornamental trees and shrubs, is by comparison an interesting spectacle, and far more pleasing to the eye.

Visitors to Tasmania could not fail to notice the pretty hedges that surround so many of the beautiful homes in that island colony.

Notwithstanding the present abundant supply of timber in the North Coast Districts and the public cry for the cancellation of reserves, our forest reserves should not be curtailed, except with the object of taking in other forest land of lesser value for agriculture or for grazing purposes.

We must bear in mind that our forests, although extensive, are rapidly decreasing, and that no natural growth can possibly keep pace with the increasing demand. Even our fastest-growing gum-tree, under the most favourable conditions of soil and climate, will take from 40 to 50 years to mature. The timber is also rapidly decreasing on private lands, and with such decrease we may reasonably look for a corresponding increase of revenue from our forest reserves. This is clearly pointed out by our late Director-General of Forests in his annual "Progress Report" for the year 1891.

Hence we observe the necessity for wise legislation, and the exercise of great care with respect to cancellations of reserves to satisfy claims on behalf of settlement. No wise Government would wish to see our forests destroyed at the expense of the next generation.

Forest Laws

were made in England in the 16th century and in the 17th century the great demand for British oak gave a new impulse to forestry. In Germany we learn that the forests are most systematically managed, and there are about 34,350,000 acres under forest in that country, and it is worthy of note that the best cultivated forests of Germany are worth from three to five times as much as the native forests, and such will doubtless prove to be the case in this country when the time comes for a more advanced system of maintenance and thinning out, &c.

In France since 1848 the area of forest land has been increased by about 7,000,000 of acres, and 9,000,000 of waste lands have been planted, and as previously stated they have (in Algeria) 12,700,000 of our Australian gum-trees planted on an area of 130,000 acres. Ireland and Scotland also have their plantations of from 3,000,000 of trees up to 60,000,000 on private estates.

I hope the time is not far distant when arboriculture shall be introduced into our public schools, each school having its arboretum and local collection of useful plants. A few hours in each week might advantageously be set apart for the instruction of such pupils as might possess a taste for botany and arboriculture. Such an institution might not only prove very interesting and valuable to the children by educating them into the various uses of plants and their culture, but at the same time it would materially assist in the great national work of reproduction and maintenance of the most useful trees and shrubs indigenous to each respective district.

Brush Forests and Brush Timbers.

Our North Coast forests are interspersed with patches and belts of brush-woods in endless variety. In many places so dense is the evergreen foliage of trees, ferns, orchids, vines, and climbers, as to form impenetrable jungles difficult of access even with the use of the knife or brushhook. From such forests large quantities of red cedar (*Cedrela Toona*) have been removed, but little now remains in a natural state except that which stands in very rough and practically inaccessible places. Beyond those varieties commonly used such as cedar, white beech, rosewood, and a few others, our knowledge is very limited. In the Macleay District alone there are upwards of 100 species which will bear favourable comparison with the best woods of the world for general, cabinet fancy work, and coachbuilding, &c. I may here mention a few of those that were tested for the Indian and Colonial Exhibition of 1887, and found to be adapted for these purposes:—Red cedar (*Cedrela Toona*), rosewood (*Dysoxylon Fraserianum*), white beech (*Gmelina Leichhardtii*), red ash (*Alphitonia excelsa*), brush bloodwood (*Baloghia lucida*) maiden's blush (*Echinocarpus australis*), yellow cedar (*Rhus rhodanthema*), coachwood (*Ceratopetalum apetalum*), corkwood (*Weinmannia paniculata, Weinmannia rubifolia, and Endiandra sieberi*), &c., &c.

I may, however, observe that our rosewood contains qualities of special value for interior fittings, *i.e.*, its extraordinary lack of inflammability, its fragrance, and its resistance to the attacks of all insects; it also possesses a wonderful power of resisting decay even underground, and I believe there are large quantities of this timber lying buried on the banks of the Macleay River, as the first settlers, when clearing the land, found the rosewood so difficult to burn that it became much easier to dig pits into which hundreds of logs of this beautiful timber were rolled and buried.

The Negrohead or Mountain Beech (*Fagus Moorei*) may be mentioned as one worthy of notice, being a tree of large dimensions closely allied to the English Beech. It inhabits the table-land and high mountain brushes. The timber combines density and beauty of grain, hardness, and durability, and favours volcanic soil. It was reported by me some years ago to exist in large quantities on the county boundary of Dudley and Clark and also on the western slopes of Mount Kippara in the Macleay District.

The Blue Beech (*Schizomeria ovata*) also a valuable timber tree of large dimensions, inhabits the Macleay and Bellinger Districts in patches, also favouring volcanic soil, and this tree, like white maple, brush bloodwood, native laurel, and many other useful indigenous timber trees of prospective value appears to be generally unknown even to the most experienced bush-man. The Fig-tree (*Ficus*) of which we have about six varieties in the Macleay District, appears to be a tree of prospective value for its timber. I have known it to have been used for bullock yokes, which proved to be of excellent quality, and the shield of the aboriginal warrior, is a good specimen

of the value of our native fig, combining that tenacity of fibre necessary and capable of resisting the force of the enemy's boomerang, nulla nulla, or even the spear without splitting. This tree may therefore be regarded as one of considerable prospective value.

In the texture of our timbers there is sometimes such a close resemblance as to render it practically impossible even for experts to distinguish one species from that of another when sawn or wrought, more particularly is this the case with the stringy bark varieties. Local names are very misleading and contradictory, hence the necessity for an acquaintance with the botanical characteristics of the woods, combined with a general practical knowledge which would lead to a ready identification of the trees as they stand in the forest.

Waste and Reproduction of Red Cedar.

The wholesale monopoly and waste of red cedar which has prevailed in the North Coast Districts since early settlement is to be deplored, and the consequent loss to the State is irreparable, although under our existing and better organised forest laws the work of reproduction has commenced, and although somewhat under difficulties in these days of financial trouble and retrenchment, may it be continued and extended far and wide. May our statesmen and legislators faithfully consider that remaining portion of a legacy which bountiful Nature in its valuable woods has entrusted to our care. The maintenance of those woods and the reproduction of our best timber trees should engage their most serious consideration and scrupulous vigilance.

Although life is unfortunately too short for many of us to witness and enjoy the ultimate results, we are not, I hope, narrow-minded enough to oppose tree-planting on this account. An impression does, unfortunately, prevail that our forests have to suit no other purpose than that of supplying wood for our immediate wants; and even after the warning of climatic changes, and scarcity of timber in many parts of the world, no regularly organised forest laws have existed in Australia until very recently, hence the great reduction and in some districts almost total annihilation of the forests. As a generally useful cabinet wood for economical purposes it appears that our red cedar (*Cedrela Toona*) is equal, if not superior, to any other in the colonies, and in consideration of its rapid growth and colossal dimensions we could not introduce a plant eligible to take the place of this noble tree in our plantations or native forests.

In the mountain brush portions of our North Coast Districts (the home of the red cedar) millions of plants might be raised, and I have endeavoured to show approximately by a careful compilation of the following figures that capital invested in this way would ultimately prove remunerative to the State.

Our North Coast reserves contain all the elements necessary for the successful culture of the most useful indigenous timber trees, and with our variable soils, altitude, and temperature, we might also successfully raise exotic timbers for such special purposes as buggy naves, &c., &c.

Our native forests, already abundant in the best hardwoods in every stage of growth, from small saplings up to trees of gigantic dimensions of 250 feet with a girth of 20 feet, could, of course, be much improved, and the spontaneous reproduction materially accelerated by a judicious thinning out of all inferior trees, brush and deadwood, while at the same time the

planting of cedar could be carried on from year to year on the most suitable portions and intervening spaces rendered vacant by the clearing and burning off of such useless material, and under such conditions our forest reserves, within easy access of water carriage, are capable of yielding a larger revenue than could otherwise be derived from the land by alienation.

Where patches of dense brushwood exist I would recommend clearing and burning off, after which the land should be ploughed, or roughly chipped in places where the plough may not be practicable, and thus prepared for planting.

The planting season should commence in June, and end not later than the 31st August; the plants which could be produced in millions from our nurseries, may be set out in rows at distances of about 21 feet apart, or say 100 plants per acre, probably this number would not find sufficient space for full development and maturity, although I believe it is better to plant thickly in the first instance as the plants would shelter each other and grow better; by this method we allow a margin for losses of unhealthy plants, and such as might otherwise be destroyed.

In order to allow a very wide margin for losses, and for plants of slow growth, I will reckon that only 15 of these trees would within a period of 50 years attain sufficient size and maturity to become fit for market. Assuming that these 15 trees would then yield 1,500 superficial feet of timber per tree, we would have 22,500 feet of cedar per acre ready for market, which, on the easily accessible portions of our reserves to navigable waters, should be worth 10s. per 100ft. on the ground, equal to £112 10s. per acre. The remaining unmatured cedar-trees in various stages of growth (the prospective value of which should by this time have attained an equal value) may also be reasonably included in our assets against the capital involved.

We have also to reckon our tens of thousands of young hardwood Eucalyptus (tall straight saplings), in many places growing so dense as to have made an almost impenetrable forest, and we may fairly assume that a moderate proportion of these young trees, or the assisted natural growth of such as would be saved after a judicious thinning out would, at the expiration of 50 years, yield millions of feet of valuable timber.

Within the period abovenamed, and under the favourable conditions recommended, these young trees would mature in periodical rotation, *i.e.*, those of the earliest stage (comprising about one-third) within from 10 to 15 years, and the remaining two-thirds in corresponding periods according to their present stages of growth.

In view of our increasing demands, and the constant annihilation of the native forests, it is reasonable to anticipate a corresponding increase in the market value of our colonial timbers; the moderate computation of 1s. per 100 superficial feet, or 12s. per tree, would therefore appear to be the minimum of a proportionate prospective value of the estimated 360,000,000 feet, worth £180,000.

Probably such an enterprise may meet with disfavour in the eyes of our legislators, involving, as it does, private enterprise without guaranteeing a direct profit in the shape of license-fees and royalty. In this case, however, the words private and public may be regarded as synonymous, and it is only by the fostering and development of our native industries, and our great natural resources, that we may anticipate future prosperity. Doubtless our unalienated forests belong to the State, and consequently the value of the timber may fairly be regarded as an asset against the capital proposed to be involved in improvements and general maintenance.

Cedar Planting.

With a view to demonstrate the success which would attend the propogation of red cedar in the Macleay District under favourable conditions, the following practical observations may be of interest.

In the years 1886 and 1887, under the instructions of the Forest Department, I planted a considerable number of young cedars on the Nulla Nulla Creek forest reserves, county of Dudley, parish of Nulla Nulla. These plants were seedlings of natural growth, simply pulled up by the roots from the bed of the creek where they had grown in groups from seed cast by old trees in the vicinity. Many of these plants may now be seen to have attained a height of 15 feet with a diameter of 5 inches. On the old Whitfield Farm, in the vicinity of Kempsey, there stand two fine cedar-trees worthy of notice as relics of antiquity; they stand alone in an open maize-field. Mr. E. Rudder, and other gentlemen, pioneers of the district, remember them well forty years ago when they were very small trees about 7 or 8 feet high. From careful measurements taken by me in October last (1893), I find that these plants have now attained the following dimensions, (*i.e.*) one measures 11 feet 6 inches girth at 4 feet from the ground and the other is 11 feet 7 inches girth at 5 feet from the ground; the height of these trees is only about 60 feet, and therefore out of proportion to the girth of stem, having evidently been stunted in their growth by too much exposure, damages by cattle, and other causes to which young trees must be liable in open pasture or farm land. Certainly the soil is rich deep alluvial, most suitable for the development of cedar, but had other conditions been equally favourable, we may fairly assume that the trees referred to would have attained greater dimensions in height and superficial contents.

Thinning-out.

Doubtless the most practicable and economical scheme of forest conservation with respect to our hardwoods would be to confine our operations to a judicious thinning-out of the abundant spontaneous growth of seedlings and saplings, and a clearing off of useless timber and deadwood upon such reserves as may be permanently dedicated to forestry purposes.

Blackbutt.

I may here direct special attention to our blackbutt (*E. pilularis*), which, in many places, forms the main bulk of our N. coast forests. It appears to be the fastest growing of our eucalypti, and one of our largest and most useful timber trees. The abundant spontaneous growth of this timber requires only maintenance and thinning-out to be rapidly developed into magnificent forests at a comparatively small expense.

Bush Fires.

The prevalence of bush fires may be set up as an argument against the success of forestry; but bush fires are partial in the north coast districts and never very destructive. Owing to the excessive moisture and consequent dense evergreen vegetation that prevails, no material damage is done to the standing timber by fire, except in places where there are large quantities of debris in the shape of felled timber (old logs, heads of trees, &c.)

In a properly thinned-out and well kept forest such debris would be burned off, and not allowed to accumulate on the ground.

It appears to me that, even in the blackbutt (*E. pilularis*) alone, we have abundant material for the development of a wise and economical system of forestry.

Hardwoods belonging to the Myrtaceæ.

The great order of myrtaceæ appears to form the most famous part of our Australian woods, and consists of about 780 species known to exist in the colonies. Of this order the genus Eucalyptus comprises about 140 species; and may be classed first, as I believe it forms the most valuable portion of our forest vegetation, and may be found in various forms and places, from the alpine heights to the tropical and arid regions of the Australian colonies.

The name Eucalyptus is derived from two Greek words, signifying "I conceal well," the cup for a long time concealing the stamens. Eucalyptus globulus was introduced into Algeria in the year 1856, and is now planted by hundreds of thousands in that country, and in many other parts of the world. No less than 12,700,000 gum trees have been planted on an area of 130,000 acres in Algeria.

In California, also, a great quantity of waste land has been planted with blue gum trees. The blue gum (*E. globulus*) and mountain ash (*E. amygdalina*) are known to attain a height of over 300 feet with a diameter of about 20 feet, and are said to be unrivalled in colossal dimensions by any other trees in the world excepting only that of the *Sequoia gigantea*, "The Big Tree of California."

The tallest of our eucalypti is undoubtedly the *E. amygdalina*, which inhabits the Snowy Mountains near the Victorian border and the Cape Otway ranges in Victoria. This tree also yields a large percentage of volatile oil.

It appears from tests of strength made between blue gum, English oak, and Indian teak, that the former is superior, having carried more weight to the square inch than either the oak or the teak.

Myrtaceous trees belong to our Australian colonies, and do not prevail in any other part of the world. In Europe this particular family is only represented by the pretty bush used for bridal wreaths, the myrtle of the ancients.

The jarrah (*E. marginata*) is also a superior timber for ship-building purposes; but, as a valuable timber tree, combining malaria-destroying exhalations which our eucalypti generally possess, the blue gum appears to take the palm. We learn that the best whale ships that furrowed the Southern seas were built at Hobart, and that the keels of those ships were made of blue gum. Each species of eucalyptus contains the well-known oil in greater or lesser proportions, and out of about twenty-six which inhabit the Macleay district, I will mention fourteen or fifteen commonly known as our best hardwoods, *i.e.*:—

Red mahogany (*E. risinifera*).
Swamp mahogany (*E. robusta*).
White mahogany, stringy-bark (*E. armensoides*).
White ironbark (*E. panicutata*).
Red ironbark (*E. siderophloia*).
Grey gum (*E. tereticorius* and *E. saligua*).
Blue gum (*E. saligua*).
Bloodwood (*E. eximia* and *E. corymbosa*).
Tallowwood (*E. microcorys*).
Brush box (*Tristania conferta*).
Stringy bark (*E. eugenoides*).
Blackbutt (*E. pilularis*).

We might also include turpentine, prickly-leaved tea tree, water gum, and others on our list of valuable hardwoods, but these do not belong to the eucalypti, although they belong to the same natural order.

Our colonial timbers are appreciated by the English navy, and it is proved that for purposes requiring great strength and durability they are unequalled.*

The characteristics of our hardwoods are generally so well known that I need not enter upon their respective qualities. I may state, however, from my own personal observations that I have known bloodwood, red mahogany, and grey gum to last underground and retain perfect soundness at heart for forty years, and I have no hesitation in adding that these timbers from matured trees would, under favourable conditions, last for 100 years; but it must be remembered that the qualities of our timber trees vary considerably with the soil and situation in which they grow.

Among other valuable properties possessed by our hardwood timbers for such purposes as jetties, bridges, &c., are their lack of inflammability. An erroneous impression appears to prevail in some departments that no other timber than ironbark is suitable for girders and railway sleepers, whereas we have timbers in our gums, bloodwoods, tallowoods, and mahoganies (although not equal to ironbark in transverse strength) that are well adapted for these purposes, and more capable of resisting decay and the ravages of white ants. We must admit, however, that ironbark is, for many purposes, one of the most useful of all hardwoods, and taking into consideration that it is a tree of very slow growth some restrictions are necessary in order to alleviate the present wholesale waste of this valuable timber which is rapidly disappearing from our native forests. It must be admitted that in the squaring of girders the best of the timber is cut away; for instance, a sapling is much stronger, more elastic and durable if simply denuded of the bark and left in the round.

The strongest poles that I have ever seen in bullock drays were made of ironbark and box saplings, roughly prepared in the round without interfering with the sapwood, and it unquestionably follows that our ironbark girders would be much better if not squared.

The white ant always attacks the inferior parts of the timber, and in the case of ironbark it will invariably be observed that the hardwood is attacked and not the sapwood.

Girders of ironbark should therefore not be squared except on the upper surface, or in such places as may prove absolutely necessary in order to complete the fittings of the culverts or other purposes for which they are used.

Our spotted gum, *E. maculata*, so common on the poorest soils and stony ridges of the Macleay River and other districts, is not only a timber suited to the abovenamed purpose, being strong, elastic, and durable, but it is also a good timber for coach-building, and for stavewood.

It is true that the young timber of this tree will not stand, especially the saplings, which I have known to have been destroyed by white ants within twelve months; hence from lack of discrimination between the matured and unmatured timber of this species, spotted gum is often very unjustly condemned, and not generally appreciated.

* For street-paving blocks and railway sleepers and taking into consideration the superiority of our colonial hardwoods for such purposes, the great demands of Canada and the United States might readily be supplied by New South Wales at comparatively more economical rates than they are being supplied by the local markets. Our best hardwoods for such purposes will last for 20 or 30 years, while the American timber will not last more than from 4 to 7 or 8 years.

Sawn and Hewn Sleepers.

The prohibition of sawn sleepers for railway purposes is also erroneous. The best timber for combined strength and durability is that which will not split, *i.e.*, such as may always be found in very large quantities lying waste in remnants of trees that have been left by splitters in the forest; and on the same principle, if we require a good maul or mallet wood we should make our selection from the cross-grained limbs of a big tree; from such limbs in the heads of our ironbarks, tallowwoods, and box trees we might also find timber most suitable for block sheaves and other purposes requiring the greatest strength and tenacity of fibre. Indeed it appears that our colonial timbers are eminently adapted for almost all the uses to which timber is applied, and while strongly advocating the introduction of foreign trees such as may be found most useful and suited to our soils and climate, our own native trees appear to be generally of more importance.

Timber in the United States.

The demand for timber is said to be increasing in the United States at the rate of 25 per cent. per annum, and the decrease of the native forests must be proportionately exhaustive. The out-put from America annually is something like 18,000,000 of feet, and it is estimated that about 37 per cent. of the total comes to Australia—this is to be deplored, seeing that we have much more durable timber in the colonies going to waste—and at the present rate of destruction of the forests in America, particularly in the States of Wisconsin and Michigan, it is estimated that there will be no timber left standing in those States 50 years hence, and that it will take 100 years under the most favourable conditions of propogation to replace the virgin forests.

There are in existence establishments manufacturing articles of wood alone nearly 120,000, employing nearly 8,000,000 persons, and using wood valued at about $550,000,000 annually. During the Civil War in North America 28,000 walnut trees were cut down to supply one single factory with the material for gun-stocks, and this valuable timber so highly prized for cabinet work is nearly exhausted.

Special Woods.

Although it is generally admitted that we are deficient in woods suitable for buggy naves, &c., I am of opinion that our forests contain abundant material suitable for such purpose, as a better experience in the art of seasoning timber will ultimately prove. The question, however, of raising exotic timbers for such special purposes may be regarded as an important one.

The Forest Department is already in possession of some samples of South Australian grown American ash turned for wheel naves, which are supposed to be quite equal to the American grown timber.

In the course of my travels in January and February last, I observed that the State Nursery at Campbelltown had produced many thousands of well grown American ash (*Fraximus americana*) ready for distribution, and that they appear to do well, although we have yet to learn whether the climate of New South Wales is suited for the successful development of this valuable timber, and I would recommend a trial in our sub-alpine regions.

Ringbarking.

That pernicious system of indiscriminate ringbarking practiced throughout the country cannot be too loudly censured. Although we know that the grazing capacity of forest land has been greatly improved and increased by ringbarking, the same good results might be obtained by a more judicious system of thinning out or leaving belts and groups of timber of prospective value, thereby adding much to the value as well as to the beauty of the land. It also appears that excessive ringbarking materially decreases the drought resisting capacity of land. Some of the best country that I have seen to withstand the effects of drought and carry stock in all seasons is undulating country interspersed with belts and groups of timber.

There are parts of the world where the operation of causes set in action by man in the destruction of the forests, have brought the once fair face of the earth to a desolation almost as complete as that of the moon, although they were previously known to have been covered with luxuriant woods, and man's improvidence in this respect caused sad conditions of unproductiveness and climatic excess. Even my own limited experience satisfies me beyond doubt that the absence or destruction of the forests involves periodic floods and droughts, and I have known squatters in the treeless plains of the interior to lose their flocks and herds, and even the kangaroo to perish by thousands for want of grass and water. How hopefully have we watched every promising cloud that appeared on the horizon only to dissolve rainless in desert air, and when the ruin was complete, and the last waterhole dried up, great atmospheric changes would set in, and the dry creeks would be converted into foaming torrents, inundating with furious floods the land over which the carcases of the famished cattle and sheep were strewn about; such disastrous scenes are not uncommon in the dry thinly wooded plains of the interior.

Let us then take timely warning, and consider the teachings of science that denuded earth parts with its warmth by radiation, and is intensely heated by insulation, and that thus in woodless countries we find the extremes of heat and cold, the winter being far more intense and boisterous, and the summer heat far more burning and oppressive.

The landscape of Great Britain has undergone a complete change; much of her waste and barren land is now covered with plantations, and we learn that the adjoining lands have consequently become more fertile, and the food production greatly increased.

Seasoning of Timbers.

As a general rule our colonial timbers are not fairly tested, being cut down and used up at any time as they may be required, irrespective of maturity or season of felling.

If the trees were cut down at the fall of the leaf when the sap is partially suspended, and then seasoned under the ordinary orthodox method of seasoning timber under proper shelter, that sudden transition of the sap, and consequent contraction, thereby rending the timber and otherwise decreasing its strength and durability would, in a great measure, be avoided. This theory, however, applies more particularly to deciduous trees of which we have very few, and is certainly not practicable with regard to the non-deciduous or evergreen varieties which form the main bulk of our Australian forests; many of our timber trees are so free in the grain and so full of sap at all seasons that we have yet to learn how that destructive contraction may best be prevented.

I have found, where practicable, that in the case of very small logs an auger hole bored longitudinally through the heart has the desired effect. The ventilation thus made causes a more even process of drying and shrinkage, but I am of opinion that the best method of seasoning timber is by denuding the tree of a portion of its bark, say, a good ring of 12 inches wide or more from the full circumference of the trees intended for sawing, at least three or six months prior to their being felled for the mill.

A tree thus ringbarked dies slowly, and in its upright position is rapidly drained of its sap through the natural channels, but when the tree is felled green, and the logs allowed to lie on the ground, the sap and acids percolate into the wood tissues and remain there, gradually decomposing and rotting the timber. The advantage of this system is obvious, and I have learned from practical experience that the best quality of timber is obtained from trees that have been stripped of their bark, and allowed to die and season in a perpendicular position.

Planting to minimise disastrous effects of Floods.

The recent flood devastations on the northern rivers are readily traceable to the improvidence of the early settlers in their indiscriminate destruction of the timber and undergrowth along the river banks, which in former years checked the force of the flood waters, supported the banks, held the silt, and slowly, but surely raising the level of submerged country.

Since the river banks have been denuded of their natural protection there has been a gradual erosion as well as a silting up of the river beds. Even now it is not too late to remedy much of the evil done by planting trees, shrubs, and grasses with long descending roots, and of the most suitable kinds for holding embankments, and as it is desirable that such plants should be of a utilitarian character, I here submit a list:—Basket willows, bamboos, wattles (*Acacia decurrens*, *A. mallisimo*, *A. dealbata*, and *A. leiophylla*). The last-named is the most suitable of the acacias, as from its roots, which extend a long distance, numerous suckers are thrown up, forming a dense thicket, which would require a great power to uproot. *Panicum spectabile* (the Coapim of Angola) rapidly sends out a network of runners, covering the ground to a great distance, while at the starting-point it forms a mass of the richest green foliage, over 6 feet high, and could thus be utilised for green fodder or made into ensilage for cattle. New Zealand flax, Marram grass, Japan clover, Indian couch, buffalo, and lucerne are also recommended. Roots of the *Arundo Donax* (bamboo end of Southern Europe) are recommended for the margin of streams, and these roots can be obtained in any quantity.

Doubtless a sloping-off of the banks would be necessary in places at the time of planting, and the plants would require to be protected by a line of fence, but when once fairly rooted they would soon form a complete network of binding to prevent further erosion of the banks.

Such belts along the river banks, assisted by the intersection of wide hedges, planted at right angles to the river, along the boundaries of the farms, would very soon (under careful maintenance) form impenetrable thickets, sufficiently honeycombed and strong to bind the soil below the surface, while above ground they would prove sufficient to stem the force of the current and hold the silt brought down by flood-waters. Doubtless flood-cuttings are also desirable, if they can be carried out, more particularly on the Macleay River and in the vicinity of Kempsey, to alleviate the terrific force and volume of water round the great Horseshoe Bend and through the

town, but such cuttings, to be successful, must be worked in conjunction with the proposed planting, and under such conditions even the present owners may live to see their devastated fields converted into smiling pastures, and their homesteads and gardens no longer subject to the destructive influences of flood-waters.

There is no doubt that our alluvial deposits have generally been formed with the growth and by the aid of the timber and brushwood which clothed the river banks at the period of early settlement, and unless this natural protection is in some adequate measure artificially restored, so will those alluvial deposits in many places slowly but surely be carried away again. Landowners should profit by the lesson nature thus clearly reveals; united action, if such a thing be possible, and a few shillings per acre on each respective holding having a frontage to the Macleay River, and otherwise affected, would make that district become one of the richest in New South Wales.

Notes on the Diseases of Plants.

By N. A. COBB.

Diseases of the Bean-plant.

I. Bean Anthracnose (*Colletotrichum Lindemuthianum.*)

"As ye sow, so shall ye reap."—Old saying.

The anthracnose of the bean plant is the disease often called bean-rust; this is a mistake, however, as the real bean-rust is quite different, and much less troublesome. The two diseases are mistaken for each other because each is characterised by the presence of brownish or rust-coloured spots. There is really little difficulty in telling the two diseases apart, if we remember that the anthracnose produces large sunken spots on the pods, while the true rust, if it attacks the pods at all (which is not often) produces elevated, rather than sunken spots.

Bean anthracnose occurs, it is safe to say, wherever beans are grown extensively. I have observed it to be abundant in various parts of North America, Europe, and Australia, and have received specimens from other parts of the world. It is so excessively common that I believe it would be a matter of difficulty to secure a shipment of seed-beans not containing it; and from this fact it will be easily inferred that each new settlement has in turn, from time immemorial, received along with its bean-seed, this disease. Should the bean be in future introduced into new settlements, as, for instance, into Western Australia or Central Africa, it is possible that, by using care in selecting seed, the disease might for some time be excluded.

The disease is not confined to any particular variety of beans; it attacks all the numerous varieties, pole as well as bush, which belong to the species *Phaseolus vulgaris, L.* It is more fatal, however, to the early sorts and to those used for cooking, pods and all, before they are ripe. The various so-called wax-beans and butter-beans are particularly subject to injury, the very quality which makes these sorts most valuable, namely, tenderness, being also that which renders them most subject to the disease.

No part of the plant is free from attack; root, stalk, leaf and pod are alike subject to attack;—but the pod is the locality where the disease is most conspicuous, and likewise the place where the greatest damage is done. The damage may be regarded as of two sorts—

1. Damage caused by preventing the growth of the pod.
2. Damage caused by injury to the seed.

1. The damage caused by preventing the growth of the pod is easily seen, and easily understood. If the pods do not grow, there is no crop. If they are misshapen and small, the crop is a partial failure. Both these causes are of frequent occurrence.

2. The damage caused by injury to the seed, is not so easy to see, nor so easy to understand; yet it is precisely on this point that I wish to lay greatest

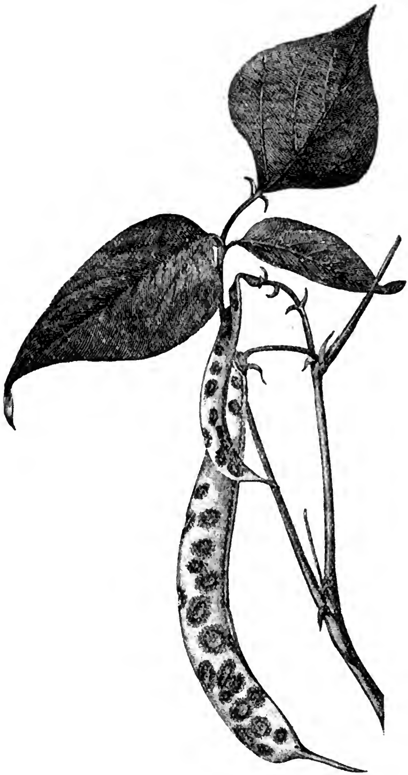


Fig. 1.—Bean pods attacked by bean anthracnose. The disease has covered the pods with sunken dark brown pods. One of the pods has failed to grow to full size, and will produce worthles seeds or none. The way in which the disease affects the beans inside the pods is shown in Fig. 2.

stress, as upon it is based the most important measure to be taken in combatting the disease. A thorough understanding of the whole matter makes it necessary to notice the cause of the disease, which is the fungus whose

scientific name is given at the head of this section, and figures of which are here inserted. This fungus grows inside the tissues of the bean pod, and its effects are seen in the death of the tissue of the pod, and its collapse, which gives rise to the brown sunken spots which are so conspicuous. The fungus extends so deep into the tissues, that it attacks the seeds inside the pod. If this occurs on comparatively well-grown pods, the size and appearance of the diseased seeds is not greatly different from healthy seed. Yet mark the difference if these diseased seeds be sown. The new seedling comes up diseased, and very often dies before it can produce its first three leaves. As everyone knows, the two halves, or cotyledons of the seed "come up" with young plant. When these cotyledons are diseased, that is to say contain the fungus as just described, they soon communicate the trouble to the tender

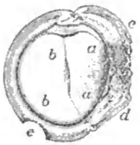


Fig. 2.—A slice cut from a bean pod, and so taken as to cut through a bean and also through diseased spots caused by anthracnose. The bean is of the sort known as the black bean, so that the outline of the seed shows as a wide black line; *aa* is one half of the seed, and *bb* is the other half. That part of the figure outside the wide black line represents the pod. Two diseased spots are shown, one at *e* and the other extending from *c* to *d*. The disease has extended from *cd* through the pod and *into the seed itself* as far as *aa*. This occurred while the bean was growing, and hindered the growth of the seed, which, in consequence, appears in the figure as somewhat one-sided. The spot *e* became diseased later on, and has not yet affected the seed.

Fig. 3.—A spore of the fungus which causes the anthracnose of the bean-plant. The spore has germinated and produced a short sprout, on the end of which another or secondary spore of smaller size and darker color has grown. These spores of the bean anthracnose are colorless, ellipsoidal, and are borne tandem on a minute stroma, of which a number generally grow together in the older sunken part of a diseased spot. They measure about $8\mu \times 17\mu$.

young plant that has sprung from them. The fungus runs riot in the succulent and tender tissues of the plantlet, which, in consequence, soon dies, or if not, at least suffers severely. Any bean-grower can demonstrate these facts to his own satisfaction, simply by sowing beans taken from badly-spotted pods, and watching the results. As soon as the young plants have produced two leaves, or even sooner, the trouble begins. The disease creeps from the cotyledons (the two half beans that come up with the plant) to the stalk and to the stems of the first leaves. Sometimes the leaves drop down, so weak do their stems become. Occasionally the stalk itself is in a like manner, so weakened that the plant topples over as if eaten off by a cut-worm. In fact I have known this disease acting in this way to completely deceive the grower, and cause him to attribute the whole trouble to cut-worms. The number of seedlings killed in this manner is various, but seldom exceeds fifty per cent. It is very often from ten to thirty per cent., thus giving rise to a very poor stand, and necessitating a great amount of tedious and expensive replanting, a loss which has to be subtracted from the margin of profit.

It will be very profitable to study a little further into the nature of this disease, for there are one or two further precautions that can be taken with advantage, and the reason for them will be made plain if the leading facts

in the progress of the disease are once clearly understood. If one of the older sunken spots on the pod be examined attentively, all the better if with a magnifying glass, a number of whitish or salmon-coloured points will be seen in the midst of the dark coloured area at the centre. These light coloured points occur when the fungus, having come to a head (formed a stroma), has begun to produce spores. The spores are very minute, and the tiny points on the sunken spot, small as they are, contain thousands of spores cemented together by a substance which is soluble in rain-water or dew. Each spore corresponds to a seed, and is capable under favourable conditions of making another diseased spot like that from which it came. When we consider that these spores are so small that we might easily pick up a hundred thousand of them on the point of a hair,—so small that hundreds of them would easily cling to a fly's foot without troubling him,—so small that the slightest gust of wind might lift them several feet from the ground, and so light that they will of themselves almost float in the air, then we can easily understand how it is that many acres of beans afflicted with this disease are such a common sight.

The spores germinate only in the presence of moisture. On a rainy day or a dewy eve they are dissolved from their birthplace and floated or spattered to new places on the same plant or on other plants. There they sprout, enter and grow, until another diseased spot has been produced, and then spores are again formed, and the whole process repeated. In favourable weather this process occupies about a week,—sometimes less. There is a saying among gardeners that beans should not be cultivated or disturbed while the dew is on them or when wet, because it spreads the "rust"—by rust meaning anthracnose, the disease we are discussing. This saying, founded in experience, is in exact accordance with the facts as discovered by men of science, and is a good illustration of the way in which practical men, learning by hard experience, have often anticipated the precautions recommended later as the result of scientific research.

As said before the anthracnose is not confined to the pod. When it occurs on the stalk it gives rise to sunken spots like those on the pod, but less defined; the spots are more inclined to run together, especially on young plants. On the leaves the fungus affects particularly the veins, turning them first brown and later on black; at the same time it affects the other parts of the leaf and similarly discolours them, and ultimately it "burns" through the leaf, making a crack with ragged edges.

Remedies.

1. *Selected Seed.*—The best remedy for anthracnose of the bean is care in the selection of the seed. The trouble taken to secure only healthy seed will be amply repaid at harvest time. The time thus spent is very profitably employed. "As ye sow so shall ye reap." He who puts in seed already attacked by anthracnose will reap a crop attacked by anthracnose,—if indeed he reaps one at all. Healthy seed is to be procured from a healthy crop. If such does not grow on the farmer's land he can sometimes procure it from elsewhere. If not, then a selection can be made from a diseased crop as follows. First, examine the crop and harvest from the part of the field least diseased, about twice as much as is needed for seed. This selection from the crop as it stands in the field will often save much work afterwards. Second, after threshing out the beans, reject all that are in any way discoloured or shrivelled. The discoloured and shrivelled spots contain the disease and the inspection must be such as to exclude if possible every bean that is spotted.

I have in some cases hand-picked the seed in the field, gathering only the *healthiest looking pods*, and I can recommend this method when the whole crop is badly diseased. If, when badly diseased, the crop be harvested and threshed as usual, many very bad pods will be threshed out and the sorting of the beans is about four times longer than the sorting of the corresponding pods.

2. *Spraying with Bordeaux Mixture.*—Whether this be profitable or not depends on a variety of circumstances. If the grower already has a spraying machine which is in use on other crops, it will undoubtedly pay him to spray his beans with Bordeaux Mixture if they are attacked by anthracnose. If he must buy a machine and spray for this disease alone, spraying will not pay him unless he is growing several acres of beans and habitually loses at least ten per cent of his crop under ordinary circumstances. If beans growing by the acre are badly attacked, spraying will pay, that is to say the additional crop will be more than sufficient to repay the cost of spraying. The spraying should be begun early. It is of little use to wait until the disease is bad and then commence to spray. As soon as the plants have the first two leaves well grown, they may be sprayed for the first time. They should afterwards be sprayed twice or more according to the weather. If the weather be rainy more spraying is required than if dry. If a rain comes on immediately after spraying, the Bordeaux Mixture is washed off and very little good will be done unless another spraying be done again at once. The object of the spraying is to cover the plants with a substance poisonous to the spores of the disease. This kills many spores that are still attached to the spot where they grew, and furthermore prevents any spores which are not so killed from germinating on the surface of the bean plants. At the first attempt to sprout the spore absorbs some of the poison that has been sprayed, and is killed. No fear of poisoning from the eating of sprayed pods need be entertained if the last spraying was done three or four weeks before cooking. All careful cooks wash the pods before snapping them. The Bordeaux Mixture is made as usual. Prof. Fairchild recommends the addition of enough soap to form a suds. This causes the spray to cover the plants better.

3. *Burning.*—The burning of all diseased vines and other trash is strongly advised. This should be done as soon as the same are of no further use. They should not be allowed to lie on the field, or anywhere where they can infect either the land or the crop. Very few farmers realize the advantage of the destruction by fire of all diseased rubbish immediately after harvest. Of course, burning is not so necessary if the following crop is to be of a different kind.

4. *Change of ground.*—Of course, the ground beneath the diseased beans becomes charged with spores, and is, therefore, a possible source of infection; for this reason the bean crop should be moved to land not recently cropped with beans if this can be conveniently done.

5. *Drainage.*—Good drainage is advisable for many reasons; among others is the fact that moisture is favourable to the growth of the anthracnose fungus.

6. *Choice of varieties.*—There is much difference in the susceptibility of different varieties, but the susceptible varieties are precisely those which are most luscious, and which, therefore, bring the highest market price, at least among snap-beans; there is, therefore, little scope for choice of varieties.

It is useless, or nearly so, to treat the seed with bluestone, hot water, or any other preparation commonly used for pickling seed.

II.—Bean Rust (*Uromyces Phaseoli* [*Pers.*], *Winter*).

Though the appearances produced on the bean-plant by the true rust-fungus bear less resemblance to common iron rust than those produced

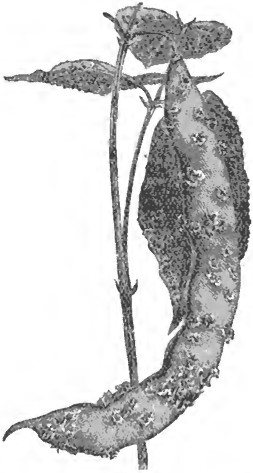


Fig. 4.—Bean-plant attacked by rust, *Uromyces phaseoli (Pers.) Wint.* The leaves and pod are covered with raised dirty-brown diseased spots, round which one sees the torn epidermis of the bean. The brown powder is composed of spores which, when magnified, appear as shown in Fig. 5.

by anthracnose, still it is best, in view of the nature of the fungi causing the two diseases, to apply the term rust to the present disease. Bean rust is very common. It is to be found on plants here and there in most crops

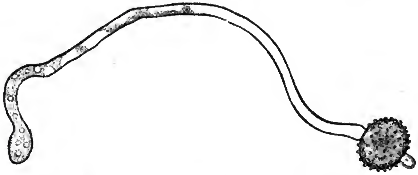


Fig. 5.—A spore of the bean-rust fungus magnified four hundred times; the spore has germinated and produced one long sprout and one very short one. These round or shortly elliptical pale-brown echinulate uredospores, measuring 15-22 x 24-30μ, are borne on pedicels of twice their own length, in brownish sori, which are destitute of paraphysis, measure from one to five millimetres across, and are situated on the leaves, more especially the under side, and less often on the pods and stalks.

of beans. Occasionally, however, it develops into a serious disease that causes considerable loss. The fungus causing the disease occurs on all parts

of the plant, more particularly, however, on the leaves; in severe cases it appears on the pods. The pustules of the fungus have a brownish, powdery appearance, and from them a brown powder can be removed on the finger. The brown spots vary in diameter from mere points up to an eighth of an inch. At first the fungus is under the skin of the leaf or pod; afterwards it breaks through, forcing the ruptured skin to one side, so that the torn edge surrounds the pustule on every side.

Remedies.

The remedies are the same as those just given for anthracnose, though much less stress is laid on the selection of seed as the rust fungus is less likely to attack the pods.

Peach Freckle.

(*Cladosporium carpophilum.*)

This is a disease common on late peaches. It attacks the surface of the peach, and gives rise at first to small, round, dark green spots, which in time grow and run together so as to cover larger areas. Often the whole of

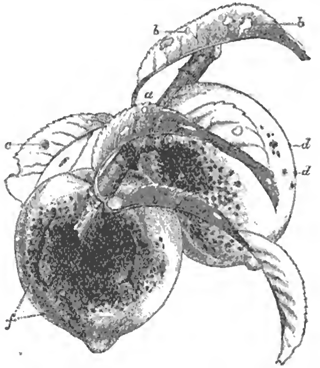


Fig. 6.—Two peaches attacked by the peach-freckle fungus, and also to a slight extent by shot-hole fungus; *a*, *b*, holes produced in the leaves by the shot-hole fungus; *c*, a shot-hole from which the centre has not yet fallen away; *d*, *d*, two scabs produced by the shot-hole fungus,—these are elevated above the surrounding surface of the peach, and are thus easily distinguished from the freckle spots shown at *e*; *f*, cracks due to the action of the freckle fungus.

one side of a peach is attacked. It is common in late stages of the disease for the peach to crack in the midst of the freckled area, and at last it becomes rotten and worthless.

This disease does not ordinarily do much harm, but it sometimes causes wholesale loss among late peaches amounting to over fifty per cent. of the crop. Even if the fruit is not destroyed its flavour and market value are nevertheless injured. Wet seasons are most favourable to the development of this disease, which is well represented in the accompanying woodcut.

Peach freckle must not be confused with peach scab. The scab attacks early or late sorts alike, and is always accompanied by leaves filled with so-called shot holes. These holes are made by the same fungus that causes the scab on the fruit. Though the scab fungus or shot-hole fungus does not

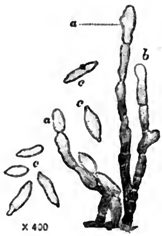


Fig. 7.—The peach-freckle fungus magnified; *a, a,* spores; *b,* top of a hypha, where a spore has begun to form; *c, c, c,* spores that have fallen off. The smooth somewhat olive-green straight or somewhat crooked, ellipsoidal to fusiform apiculate spores, are one-celled, sometimes two-celled, and measure 11-20 x 5 μ; they are borne singly or tandem on irregular branched septate hyphae, so wefted together as to produce greenish "freckles," which, by becoming confluent, cover irregular areas, sometimes upwards of twenty-five millimetres across.

damage peaches so much as it does apricots, yet it sometimes materially injures peaches. The scabs caused by the shot-hole fungus are *raised*, while the spots caused by the freckle-fungus are not. Scabby peaches are rough; freckled ones are not. The scabs are rusty looking, while the freckles are dark green or black. The two diseases may occur together on the same peach. Such a case is shown in the above figure.

Remedies.

Spraying with Bordeaux Mixture is probably a good preventive of this disease. The spores of the freckle-fungus are poisoned and killed by the mixture. I have not yet had an opportunity to spray for the prevention of this disease, but would advise the use of Bordeaux Mixture, one-half the usual strength, to be applied at intervals of a fortnight for about two months previous to ripening; in other words, long after the leaves have become old and hardened. This advice is given because the spring foliage of peach trees is injured or killed by Bordeaux Mixture.

Black Rot of the Tomato.

(*Macrosporium Tomato.*)

This is the worst disease attacking the tomato, and is only too well-known to all who have grown that fruit. Dark spots appear first, usually at the blossom end of the fruit; these slowly enlarge until by the time the fruit is ripe it is spoiled—half or nearly the whole of the tomato has turned black and collapsed. The fungus that causes the trouble is a black, or rather dark green, growth, which gives rise on the surface of the tomato to dark green velvety-looking "cushions," composed almost entirely of spores. The form of these spores is well illustrated on the following page.

Other fungi occur together with the *Macrosporium*, but they are of secondary importance, as they never occur except the *Macrosporium* has first

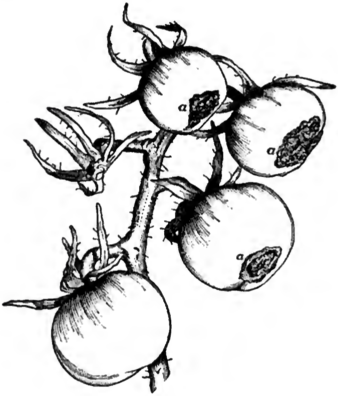


Fig. 8.—Tomatoes attacked by black rot (*Macrosporium tomato*). The rot is seen at *a*, *a*, *a*, spreading from the blossom end. The lowest tomato is not yet attacked.

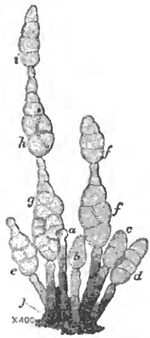


Fig. 9.—Small portion taken from one of the dark green cushions caused by the black-rot fungus of the tomato (*Macrosporium tomato*). *a*, a spore just beginning to form on the top of a hypha; *b*, a spore of one cell, being the result of the growth of such a beginning as is shown in *a*; *c*, a spore that has become two-celled; *d*, a spore that has become four-celled; *e*, a spore that has become many-celled; *f f*, a spore that has become many-celled and produced another spore on its tip; *g h i*, a chain of three spores; *j*, bulbous base of the aerial hyphae. Below *j* is the surface of the tomato. The dark olive-green to brownish spores vary in size from 15 x 9 μ, when one-celled and ovate, to 100 x 20 μ. when many-celled and obclavate. When compound they are divided in a muriform manner in both directions, and are borne singly or tandem on the tips of erect caespitose simple or nearly simple blackish sparingly septate aerial hyphae, which are considerably shorter than the largest of the spores, and have a diameter of 4—5 μ. The spores have a crenate contour and in germinating, each cell of which they are composed may give rise to a hypha.

appeared; they are not known to by themselves cause damage. Of these secondary forms no less than three are common. The spores of these three

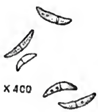


Fig. 10.—Spores of *Fusisporium*, magnified.

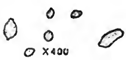


Fig 11.—Spores of *Penicillium glaucum*, magnified.

Fig. 12.—Spores of *Glœosporium frutigenum*, magnified.

are here figured. The first causes a whitish or salmon coloured growth on the surface among the dark green cushions of the black-rot fungus, and is a

species of *Fusisporium*. The second is the common ripe-rot fungus, *Glœosporium frutigenum*. The third is the green mould, common on bread and old boots, *Penicillium glaucum*.

Remedies.

1. *The use of trellises.*—The black rot fungus grows best in a damp atmosphere, and near the ground. Hence, if the tomato vines are kept from the ground by a high trellis, or are tied to stakes, they suffer less. Merely trellising the vines will not prevent or stop the rot; it will only hinder it. A further precaution consists in cutting off the tops of the vines. This lets in more sunlight, and does not injure the vines if they are growing thriftily. Both the above measures should be adopted regardless of disease; but we have noticed that tomato-growers frequently neglect them.

2. *Choice of varieties.*—Some varieties of tomato suffer less than others, though there is no variety known that is proof against the disease. The smoother varieties—that is, those having no creases—generally suffer least. These smooth-skinned, nearly spherical sorts are also superior, so there is a double reason for growing them.

3. *Burning diseased fruit and vines.*—Never allow rotten tomatoes to lie about; gather and burn them as soon as they show signs of disease, which is often when they are no larger than peas. This precaution is one that undoubtedly pays. Nothing less than the complete destruction by fire of the diseased material will answer; burial is not recommended.

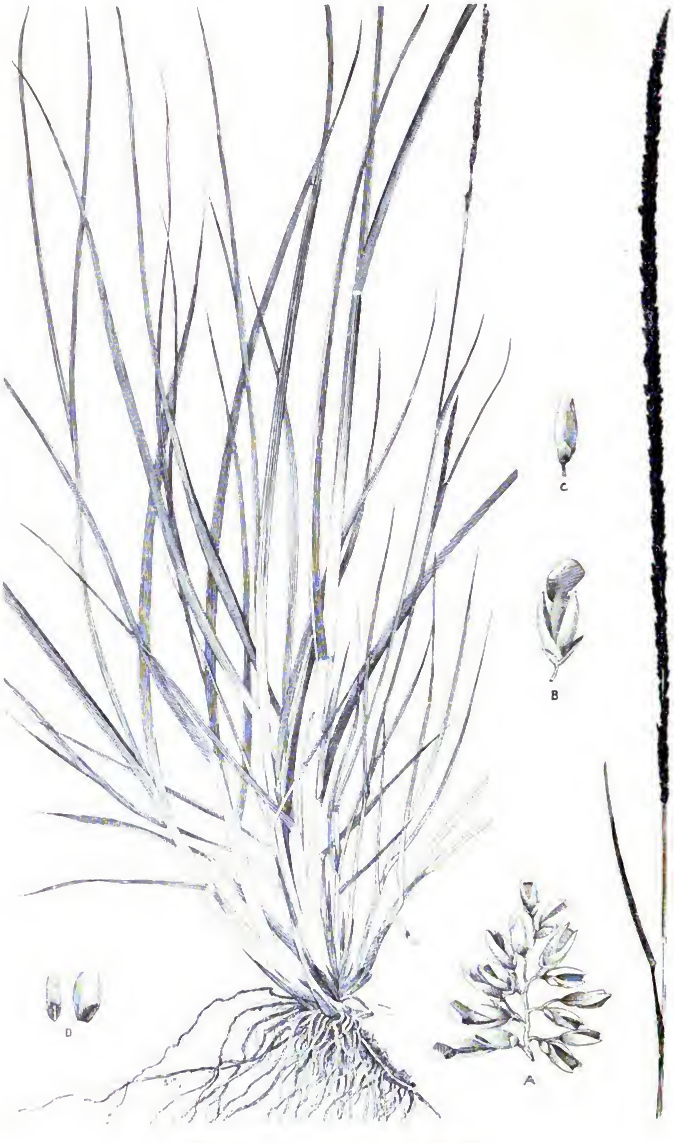
4. *Drainage.*—The disease is usually worse on undrained land. Good drainage is therefore advisable.

5. *Choice of seed.*—Never use seed from diseased tomatoes, or, if it can be avoided, from vines that have shown the disease.

6. *Change of ground.*—When the disease has been bad on a given piece of ground it is not advisable to plant it again with tomatoes for a season or two. A better crop of tomatoes will be obtained by putting the crop on other ground, if such that is suitable can be had.

7. *Spraying with Bordeaux mixture.*—The beneficial results of spraying tomatoes for black rot are still questionable. Spraying the fruit after it is once attacked is nearly useless. On the other hand, some good appears to result from spraying the young vines, and then periodically once in two or three weeks. Spray in particular the young fruit. I would not, at present, advise a grower to invest in a spraying machine with a view to making greater profits through spraying his tomatoes; but if he already has a spraying machine, or has other crops that it would be profitable to spray, I should, without hesitation, advise spraying the tomatoes as recommended above, if it can be done at the same time as other spraying.

In general, then, it will be seen that the measures recommended to be taken against the black rot of the tomato are such as can be based on what we know about the fungus that causes the rot. Destroy this fungus whereever it can be seen, and be very suspicious of any vine or piece of ground where it has appeared. The spores are small and invisible, are produced by thousands, and are easily spread by the wind, by water, and by cultivation; they have great vitality, and thrive best where it is moist. These facts show why it is best to trellis, trim tops, and drain, as well as the reason for removing to new ground.



Sporobolus indicus, R. Br.

"Parramatta or Tussock Grass"

(11659-94)

A Mango Blight.

(*Pestalozzia uvicola*, Speg.)

Mangos frequently reach the Sydney market covered, or partly covered, by a jet black blight, caused by the fungus whose name is given above. The

X 460

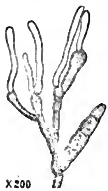
Fig. 13.—Spore of *Pestalozzia uvicola*, Speg. The black globose erumpent pustules, half a millimetre or more across, occur close together, each being surrounded by the torn cuticle of the fruit, and bear five-celled spores measuring 40 x 7 μ., each of the end cells being hyaline, the apical one bearing three colourless cilia, 14 x 1 μ.

same fungus is not uncommon on grapes. The spores of this fungus are poisoned by Bordeaux mixture. This fact points toward the Bordeaux mixture being a suitable mixture with which to experiment on mango trees attacked by this fungus.

Common Disease of Grass, *Sporobolus indicus.*

(*Helminthosporium Ravenelii*, Curt.)

Blighted specimens of this grass, *Sporobolus indicus*, have often been referred to me by stock owners with the query: "Is it injurious to stock?" To this I can only reply, "Probably not." I have fed large doses of the fungus causing the blight, to fowls without causing any serious symptoms.



X 200

Fig. 14.—Portion of the mycelium of the fungus, *Helminthosporium Ravenellii*, which blights the heads of *Sporobolus indicus*. A single five-celled spore is shown. The dark-coloured irregular nodose septate branched hyphae form spongy masses in place of the fruit of the grass, and bear a large quantity of three- to five-septate brownish spores, measuring 50—90 x 5 μ.; these occur singly on the branches.

Sporobolus indicus is a harsh, wiry grass avoided by stock so long as anything else decently good is available, and they therefore eat but little of it under ordinary circumstances. A figure of the grass is given, as well as of the fungus. The blight is black, and appears only in the heads of the grass. It resembles a smut in appearance.

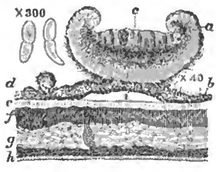
A New Australian Fungus.

By N. A. COBB.

The species of *Peziza* here described was found by Mr. J. J. Fletcher, secretary to the Linnean Society of New South Wales. Its abundance on the leaves of *Lyonsia*, most likely of the species *reticulata*, and its rather striking appearance, led him to collect it and forward it to the author.

Peziza, Dill.

Peziza lyonsiae, n. sp. Cups somewhat gregarious on both sides of the leaf, on ashy grey, roundish, often confluent, spots, 3—10 millimetres across, flat, sessile, round, varying in diameter up to one millimetre, and having incurved margins. The mycelium covers the surface of the leaf with a thin ash-coloured layer, which scales off rather easily. From a little distance the



Cross-section through the fruit of the *Peziza lyonsiæ*; *a*, perithecium; *b*, ash coloured mycelium, growing on the surface of the leaf of *Lyonsia*; *c*, the eight-spored asci; *d*, a young perithecium; *e*, upper epidermis of leaf of *Lyonsia*; *f*, green palisade tissue; *g*, loose parenchyma, containing here one vuscular bundle; *h*, loose epidermis of leaf of *Lyonsia*; *i* shows where the mycelium of the fungus has been pulled away in making the section.

leaves appear as if attacked by a scale insect. The young perithecia are spherical and pilose. The ripe perithecia are brown, and nearly smooth; they measure ·5 mm., and have a raised margin. The fusiform or cylindrical asci measure about 75 x 40 μ. The smooth, colourless spores are two-celled, sometimes straight, sometimes curved, and measure 25—28 x 8 μ. Paraphyses cylindrical filiforum, and colourless.

Habitat.—Parasitic on the leaves of a species of *Lyonsia* (*reticulata* F. v. M. ?), New South Wales, accompanying the black fungus so often seen on that plant. The *Lyonsia* did not appear to suffer seriously.

Apple Culture.

By ALBERT H. BENSON.

CHAPTER II.

Thinning and Gathering the Fruit.

Where the trees are heavily overladen the fruit should be judiciously thinned, so that the fruit that remains may have a chance to attain a fair size and develop properly, as it will then be more saleable than the undersized fruit from an overladen tree, and the tree itself will not be injured by the weight of the fruit breaking limbs, or, as sometimes happens, by splitting the main trunk, thereby seriously injuring, if not actually destroying, the tree.

In the case of many of the earlier varieties, especially cooking ones, the fruit may be allowed to develop to a sufficient size to be saleable, and then thinned, the balance of the fruit being allowed to come to maturity. In all other cases where the trees are heavily loaded, and unable to properly develop all their fruit, they should be thinned as soon as the crop has properly set, and there is no further chance if any fall taking place. The amount to be thinned will depend on the kind of fruit, the nature of the soil, age of the tree, and the brittleness or toughness of the wood, as different varieties of apples vary very much in this. With large cooking varieties the thinning should be severe so as to produce a large-sized fruit, yet not so severe as to produce oversized fruit, which are usually of little value, being soft and coarse. With desert apples, where a medium sized fruit—that is to say, a fruit not exceeding 3 inches in diameter—is required, it is not necessary to thin so severely, but as many fruit should be left on the tree as the tree is capable of growing to perfection, without breaking down or otherwise injuring the tree. There is another danger from over-cropping that I have omitted to mention, and that is the danger of opening the head of the tree too much by the weight of the fruit spreading and bearing down the branches, thereby exposing the inner parts of the tree to the direct action of the sun, which, striking right on the unprotected bark, is often the cause of sun-burn which is usually the immediate cause of several diseases, notably scald, or, as it is generally called, fire-blight.

Simple as the gathering of the fruit seems, it is nevertheless a very important operation, and one that it will pay the growers to attend to thoroughly, especially where the fruit has to be sent some distance to a market, or where it is intended for export or for storing for our own local markets. Always gather the fruit carefully, bruising it as little as possible, as a bruised fruit is always a blemished fruit which detracts from the appearance, and consequently the selling value of the whole case, and in the case of most varieties of apples, bruising produces an early decay. Even where there is a market for the fruit as soon as it is gathered, handle it carefully; it will both

look and sell better. Except in the case of early and some varieties of mid-season apples, which can be gathered and marketed when only partially ripe, all apples should be allowed to remain on the trees till fully grown in order to develop their full flavour and quality, which will be matured by storing. Keeping varieties of apples if gathered when immature will always shrivel, but early varieties when left on the trees too long will become dry and mealy. Actual experience is the only means by which the grower can determine the exact time or stage at which to gather the fruit, as variety, soil, and climate have always to be taken into consideration; but a good general rule to go by is—gather early fruit before thoroughly ripe, or it will become mealy, but allow late varieties to become thoroughly developed, or they will shrivel and not mature their full flavour when stored.

Grading, Packing, and Marketing.

I cannot lay too much stress on the grading and packing of the fruit for market, as without carefully attending to these most important operations the fruit will never show to the best advantage, no matter what its quality may be; and I am sorry to say that this is a matter that many of the fruit-growers of this Colony fail to appreciate the importance of, but send their fruit to market anyhow—big and little, good and bad, all mixed up indiscriminately—and then they wonder at the bad prices they obtain, and generally end by throwing all the blame on their agents, and by running down fruit-growing generally; whereas the whole blame for their want of success rests entirely on their own carelessness.

If the fruit is required for immediate sale after being carefully gathered, it should be graded into different sizes, handling the fruit carefully to prevent bruising, and only one size of fruit should be packed in each case. It should be tightly, evenly, and neatly packed, and on opening the case the fruit should be equal throughout, the bottom as good as the top. When the fruit has to be sent a considerable distance, or where it is required for export, it should always be sweated a little before packing; and this is easily done by allowing the fruit to remain in the picking boxes for two or three days, and placing the cases where they will get plenty of air. Care should be taken to gather the fruit when perfectly dry, and after they have sweated they should be first graded into size and all blemished, wormy, or otherwise imperfect fruit rigidly excluded. After being graded, wrap each perfect fruit in tissue paper—a tough thin paper is best, as it is less likely to tear—placing the eye end of the fruit in the centre of the paper, and folding or twisting the ends of the paper round the stem. In packing the case, place the stem end of the fruit downwards, and pack very evenly and tightly so that there will be as little shaking as possible. It is a very good plan to place a layer of wood wool at the top and bottom of the case, as being of an elastic nature it prevents in a great measure the bruising of the fruit. Use light, neat cases, and always mark the grade and kind of fruit distinctly on the case. It is also a good plan to use a distinguishing brand where large quantities are to be shipped, and the brand should be stamped on the wrappers and also on the case. If this is done, and a high standard of excellence is maintained, there will be no difficulty in disposing of the fruit, as the dealers in every market always give the preference to any brand that they know from experience is honestly packed and can be depended upon; but once deceive them and it will take years before you will regain their confidence.

The successful marketing of any kind of fruit depends mainly in the manner in which it is got up for sale—even grading, honest and neat packing, the exclusion of all blemished or wormy fruit, and the use of light, clean, neat cases, will do more to sell the fruit than anything else, as good fruit, well shown, will sell readily, even in a dull market, when the same fruit, unattractively got up, would be often unsaleable.

Storing.

In order to develop their highest flavour late varieties of apples should be allowed to remain on the trees till they have attained their full size and are thoroughly ripe, when they should be gathered and stored for keeping; the fruit maturing and mellowing whilst stored. Fruit for storing requires very careful handling, and all bruised, blemished, or diseased fruit must be thrown out. The fruit should only be gathered when perfectly dry, and it should be stored in a building possessing as even a temperature as possible, and in which the ventilation can be easily adjusted. The success in storing apples depends mainly on the maintenance of an even temperature not exceeding 50°—55° and of a slight but not excessive ventilation, as too much air or too dry air would cause the fruit to shrivel. An expensive or elaborate building for storing apples is not at all necessary; the essential qualifications for a store are good insulation, so that it is not subject to any sudden changes of temperature, moderate ventilation that can be regulated, and a moderately dry air. A simple and very good store can be made where there is the slope of a hill available, by cutting away a portion of the side of the hill, so as to form one of the sides and a part of one end of the store from the hill itself; the other side and the balance of the end being formed of a double wall of slabs having a foot of soil between them. A ceiling of slabs should also be made having spaces left for ventilation that may be opened or closed as desired, and over the slabs there should be a layer of about 6 inches of soil. Over the whole store there should be a roof of bark or iron which should extend well beyond the ends and outer side, so that the rain would not be able to beat in. All the water from the roof should be carried right away, and a small surface drain should be made on the hill side to catch any surface water that would otherwise get on to the ceiling and through on to the fruit. The side of the store formed by the hill should be slabbed up, and a floor of slabs should be placed at about 1 foot from the ground, having taken the precaution to put in a good drain to take off all seepage water first. The end at which the fruit is to be taken in and out at should face the south, and all of this end, except that required for a door, should be made similarly to the outer side. In the door there should be sliding panels for ventilation to be opened or closed, so as to regulate the amount of ventilation required. The fruit may either be stacked in bins on the floor, piling the fruit to a height of 2 feet, or what is better, it may be placed on shelves arranged in the middle, round the sides, or both. Storing on shelves is preferable, as if any fruit decays it can be easily taken out. When first stored the door and the ventilators in the ceiling should be left open so as to allow the moisture thrown off by the fruit during the sweating to be carried off, after which the door should be closed and the ventilation moderated. Where a hillside is not available and where strong black clayey loam or adobe can be obtained, a good store can be made with walls of sun-dried bricks having a roof projecting well beyond the walls, and having a space between the roof and the wall-plates for ventilation. A plaster or slab ceiling can be made and the store can be

fitted up to suit the requirements of the orchardist as previously described. If adobe is not available a good substitute is made from a clay loam, cow-dung, and chopped straw, which is mixed well together and packed tightly between a double wall of boards placed at such a distance apart as it is wished to make the walls thick. When dry the boards are removed and the mud or cob-walls remain, but as in the case of the adobe or sun-dried walls it is necessary to have an overhanging roof so that no rain can get on to the walls.

Utilising Surplus Fruit.

Drying.—The apple is easily and readily dried, and when good cooking varieties are used and the operation is well and carefully performed the result is a very saleable article, possessing all the qualities of the fresh fruit, and in a compact form that if well packed will keep for years, and may be sent to any market no matter how distant. At present we are practically dependent on America for our supply of dried apples, the little drying that is done in the Colony being usually of the very crudest nature. For drying, large, firm, good cooking acid apples having a white flesh are preferable, but other kinds may be dried if wished but will not turn out so well. For drying apples the following outfit is necessary:—

1st. A good combined peeler, corer, and slicer with which to prepare the fruit. (Several good patterns are obtainable in Sydney.)

2nd. A sulphurer in which to bleach the fruit when prepared.

3rd. A machine drier or evaporator with which to dry the fruit after it has been sulphured, as owing to the uncertainty of our climate especially in the best apple-growing districts it will rarely be found practicable to sun-dry to any extent, so that it is better to depend on an evaporator. Several different kinds of evaporators suitable for small orcardists are now procurable in Sydney, but if any one is desirous of going in for evaporating on an extensive scale, then it will be advisable either to import a large factory drier or else to construct a drier to meet the special requirements.

In drying apples the fruit is first peeled, cored, and sliced, and the slices laid on the evaporator trays. When the trays are full they are placed in the sulphurer with as little delay as possible as the fruit rapidly discolours after being cut. The fruit is kept in the sulphurer till properly bleached the time for which varies with the different kinds of fruit, but it is better not to sulphur too long or the dried product will taste of sulphur. The bleaching should be long enough to whiten the fruit but no more. After its removal from the sulphurer the fruit is placed in the evaporator where it remains till it is sufficiently dry, that is to say, until there is no longer any free moisture left in the fruit, but the fruit should be pliable and not baked. Generally it is better to place the fruit in large boxes to sweat for a few days before packing, as during the evaporation some of the fruit is sure to be dried more than the rest and some less and the sweating will even up the whole. When the fruit has evened up it should be packed in light clean boxes and be neatly and well got up. In drying apples it takes about a bushel of green fruit, on an average, to produce 6 lb. of dried fruit. Fifty pounds of fresh apples will produce about 30 lb. of meat and 20 lb. of refuse (core, skin, &c.) and the refuse is also dried and used for jelly-making, or it may be used up whilst fresh for jelly.

As I mentioned in the previous part of this article apples are largely used for jelly, and for this purpose small fruit or the refuse from the drier may be used.

Making Jelly.

Take the whole fruit, slice it, and place it in a steam-jacketed kettle or large preserving pan, taking care that it is either of copper or lined with enamel, the latter being preferable; place a little water over the fruit to prevent burning and slowly raise the heat to the boiling-point so that the juice of the fruit may be readily extracted, when it is strained off and filtered, so that it is quite clear. To every pint of juice now add 1lb. of best confectioner's sugar, place the whole in the preserving pan or steam-jacketed kettle and boil gently till a small portion jellies on cooling, when it is ready for putting up in glass or tins.

During the boiling the jelly should be carefully skimmed so as to remove any extraneous matter, as if this is neglected the jelly will not be clear. Absolute cleanliness in all the utensils and the use of nothing but the best sugar are the great secrets in making not only apple jelly, but also all other fruit, jellies, and jams. The manufacture of cider I treated in a previous article in the *Gazette* and the manufacture of apple butter I referred to in the beginning of this, so I need not refer to them again. As I intend this article to be as general as possible I think it advisable to conclude with a brief and simple description of the principal diseases, both insect and fungus, which are found in this Colony attacking the apple and apple trees, and although most of the information has already appeared at different times in the *Gazette* I think it may be useful to our fruitgrowers to repeat it here in a condensed form.

Diseases of the Apple.

Insect Diseases—Codling Moth.

At the present time no insect is causing more trouble to the apple grower than the Codling Moth, the larvæ of which have destroyed the greater portion of the apple and pear crops in many districts during the last few years and have now spread to nearly every part of the Colony except isolated districts, and the pest is still rapidly spreading.

I will not describe the insect in detail, but anyone who wishes to obtain the best and fullest information on the subject cannot do better than study Mr. Olliff's article, which was published in the *Agricultural Gazette*, Vol. I, p. 3.

The life history of the insect is briefly as follows:—During the winter the larvæ remain hidden under pieces of loose bark on the trees, in holes or cracks of the trees, in stakes adjoining trees, in empty fruit cases, buildings where fruit has been stored, fences adjacent to apple or pear trees that have been affected, and other places where they can find a snug and dry retreat. At the approach of spring the larvæ pupate and when the trees are in blossom the moths hatch out. Just as the petals are falling, that is when the fruit is setting, the female moths lay eggs in the calyx of the young fruit, rarely laying more than one egg in each fruit. The egg remains in the calyx of the fruit for a time before hatching, but as soon as the young worm or larvæ emerges from the egg, it starts to eat round the calyx of the fruit, and then burrows into the fruit, developing with the fruit till it reaches maturity, when it either falls to the ground with the fruit or else it lets itself to the ground with its spinaret. On reaching the ground it at once proceeds to the tree or other adjacent shelter, seeks out a secure retreat, spins its cocoon, pupates and again turns into a moth. This time the moth lays its eggs either in the calyx or anywhere on the fruit where there is little chance of the egg being destroyed, such as where two fruit touch each

other. The egg develops and the larvæ eats its way into the fruit as previously described. In all parts of the Colony there are at least two crops, and in the warmer parts three in a season, so that the pest spreads very rapidly. The means of combating the codlin moth are very simple, and if universally carried out would soon result in greatly reducing the amount of damage done. They consist firstly in spraying the trees in spring, just as the fruit is setting, with Paris green, a trace of the poison being carried by means of the spray into the eye of the fruit where the moth lays its eggs. As previously described, the young larvæ usually eats round the eye or calyx first before boring into the fruit, and if there is any Paris green present in the calyx then it is very probable a portion will be eaten by the larvæ when it will be at once destroyed. As the moths do not all hatch out at the same time it is advisable to repeat the spraying in a fortnight. In spraying for codlin moth with Paris green the following precautions must be carefully attended to. Never use stronger than 1 lb. of Paris green to 160 gallons of water, keep the mixture well stirred whilst using, and never spray in a burning sun or on a very windy day. The second remedy is to catch the larvæ as they leave the fruit, and this is done by carefully removing any shelter that may exist on the tree itself or adjacent to the tree, and then tying a band formed from a piece of a grain sack or other suitable material tightly round the trunk of the tree. The band should be from 4 to 6 inches wide and long enough to go round the trunk and it should be very tightly tied on, the string being placed in the centre and the upper portion of the band turned over it. All other shelter having been destroyed the larvæ find their way to the band and spin up in it. At least once a week the bands should be examined and all larvæ found in them destroyed. The easiest and quickest way to destroy the larvæ is to have two sets of bands, the bands containing the insects are taken off, placed in a tin so that no insects can escape, and clean bands are put on in their place, first taking care to destroy any larvæ that may be found attached to the trunk itself. The easiest way to destroy the larvæ in the bandages is to place the bandages in boiling water for about five minutes. This is surer, quicker, and cleaner than killing the insects with the fingers, and also when the

Fig. 10.
Moth—Natural size.

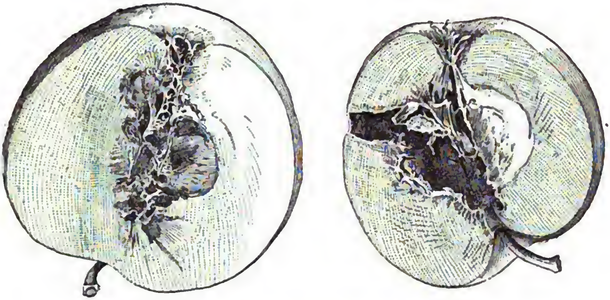
Fig. 11.
Pupae—Natural size.

Fig. 12.
Larvae magnified.

insects are crushed in the bandages, the bandages often become infested with small ants feeding on the dead larvæ and which so worry any larvæ that come to the band that they go elsewhere and are not caught.

In addition to the spraying and banding it is also advisable to destroy all infested fruit, and during the winter the trees should be well attended to. All loose bark should be remned, using for this purpose a triangular scraper such as is used on board ship, and all crevices or other places likely to harbour any larvæ should be carefully examined, and all larvæ found destroyed. All fruit cases that have held infested fruit should be carefully examined, and if they contain any larvæ they should be kept in boiling water for at least ten minutes. A thorough disinfection of fruit cases will be

found of the greatest value, as in addition to destroying the larvæ of the moth the germs of many fungus diseases will also be killed. Any other places likely to harbour any of the insects should be well overhauled, and



Figs. 13 and 14.—Fruit attacked.

all larvæ killed whenever and wherever they may be found. If these remedies are properly and universally carried out, and this can only be done by concerted action on the part of our fruit-growers, the codling moth will soon be a thing of the past, or only exist in such numbers as to do comparatively little damage.

The above drawings show the appearance of the insect in its different stages, and also the way in which they destroy the fruit.

Woolly Aphis or American Blight.

Next to the codling moth the woolly aphis is the worst insect pest that apple-growers have to contend with, and it is a pest that requires the most careful and constant attention on the part of the orchardist to keep in check—as once let an orchard become thoroughly infested, root and branch, and it is an exceedingly hard if not well nigh hopeless job trying to eradicate the disease; but if taken in time and checked before it is able to spread to any extent, then with a little care and attention at intervals it may be kept within bounds and do little harm. In the previous part of this article, when treating of stocks for the apple, I strongly emphasized the necessity for working all apple-trees on blight-resistant stocks, as by so doing the ravages of the insects are confined to the portion of the trees above ground, and the roots are free and do not form a breeding ground with which to replenish the tops of the trees when the insects have been killed off by spraying. The following illustrations show the appearance and effect of the insects in roots and branches

The following are the best remedies for the woolly aphis:—

1. The use of resistant stocks.

2. When the roots are infested the insects may be destroyed by injecting bi-sulphide of carbon into the ground, as done in the case of the Phylloxera

of the grape, or the insects may be made to leave the roots by forking hot lime or a little gas lime into the soil near the roots. Night-soil forked in

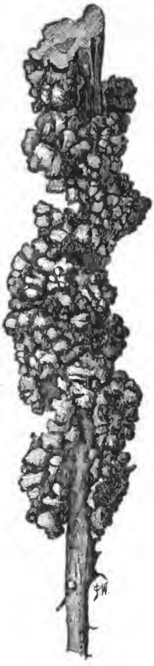


Fig. 15.—Root very badly infested.

Fig. 16.—Affected branch (small).

round the roots will also cause the insects to leave, and this remedy also often drives the insects from the top of the tree as well.

3. Where the insects infest the top of the tree, the quickest and cheapest remedy is to spray the tree with the resin and soda wash, made as follows:—

Resin and Soda Wash.—Take 4lb. of resin and 3lb. of washing soda, and boil in two gallons of water, adding water slowly to make up five gallons boiling all the time. The mixture should be boiled till the resin is thoroughly dissolved, which is known by the mixture becoming of a brown colour. Water is now added to make forty gallons of wash, when it is ready for use. This wash works easier in the pump, and is more efficacious when applied at a temperature of about 130°. It is an exceedingly cheap and efficacious wash, and will not injure the fruit or foliage in the slightest, and it has the advantage of killing large numbers of aphis eggs, as well as the perfect insects. This is done by covering them with a glaze or varnish of resin, which prevents the eggs hatching. It should be applied at any time that the aphis are to be found, except during a burning hot day, or with a strong drying wind blowing.

The spray should be applied with as much force as possible, as in order to destroy the insects it is first necessary to knock off the woolly covering with which they are protected before the spray can have any effect on them. The best nozzle for this purpose with which I am acquainted is the Nixon (see illustration), as the spray produced by it is direct, fine, and when a good pump is used has great force.

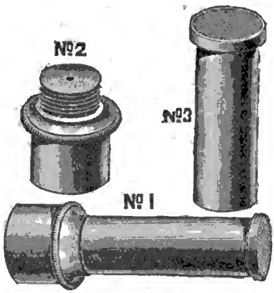


Fig. 17.—Nixon's nozzle—four of these nozzles of two sizes go with each No. 3 Climax Spraying pump.

When the insects are not numerous they may be kept in check by smearing the affected parts with castor oil, but where they are at all plentiful the spray pump is the best thing to use. In pruning varieties that are bad blighters, it is a good plan to cover all the larger cut surfaces with grafting wax-rubber paint or shellac varnish, as newly-cut surfaces are always very liable to attack.

Mussel Scales—(Mytilaspis citricola).

These insects, which get their name from a resemblance to a mussel shell, live by suction on the sap of the tree or on the juice of the fruit. In their earlier stages they travel about the tree seeking for a suitable spot to which to attach themselves, and to which, when found, they remain attached for

the rest of their existence, the body of the mature insect becoming finally a mere receptacle nearly filled with eggs or young scales. When these insects are present in large numbers they very seriously affect the vigour and health

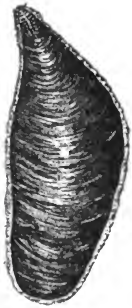


Fig. 18.—*Mytilaspis citricola*—Upper side, much enlarged.

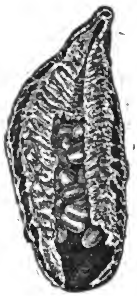


Fig. 19.—*Mytilaspis citricola*—Under side, much enlarged, showing the eggs.

of the tree to which they are attached, and if measures are not taken to destroy them they will eventually either kill the tree or render it valueless. These scales are already well established in several parts of the Colony, and are spreading, so that they should be checked wherever seen. In some parts of Tasmania they are evidently bad, as large numbers of apples more or less covered with them are now being imported from there into this Colony, and these infested fruits promise to spread the disease. The insects attack both the fruit and the wood, both large and small branches, and are sometimes so

Fig. 20.

numerous on the wood that they entirely cover it. When they attack the fruit they greatly disfigure it, the part or parts of the fruit to which the insects are attached being contracted in its growth as compared with the portion of the fruit that is free.

The following drawings show the mature female scale (*mytilaspis citricola*) much enlarged, and the effect and appearance of the insects on the fruit and wood, the insects being rather under natural size:—

The enlarged drawing of the female scale shows the egg sac and gives an idea of how prolific these insects are, and of how quickly they increase when unmolested. In addition to attacking the apple, this scale infests the hawthorn as well, and if for this reason only, I strongly disapprove of the

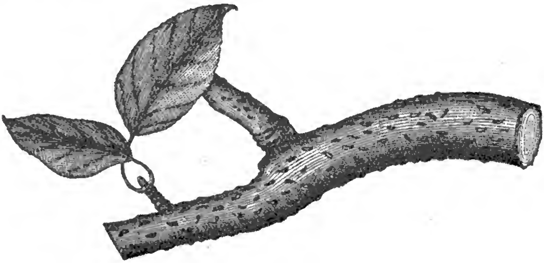


Fig. 21.

use of thorn hedges as fences or shelters for apple orchards as they form a harbour from which it is practically impossible to dislodge the scales, and are therefore a breeding ground for them and from which the scales can easily spread to the orchard. The two species of mussel scale, mytilaspis pomorum and mytilaspis citricola are very similar in appearance, but differ slightly in colour and shape. The damage done by either species is the same, and the same remedies are used.

The means by which these insects may be destroyed are as follows:—

1st.—Where the trees are very badly affected, the trunks and main branches should be scraped to remove the scales, the rest of the tree being sprayed.

2nd.—Spraying during the winter with a strong caustic wash that will destroy the mature scales. For this purpose Rovery's scale exterminator or a resin wash made as follows will answer: Take 20 lb. of resin, 6 lb. of caustic soda (70 per cent.), 3 pints of fish oil, water to make 80 gallons; place the resin, caustic soda, and fish oil in a larger boiler with 20 gallons of water, and boil for three hours, then add hot water slowly, and stir well till there are, at least, 40 gallons of hot solution; then add cold water to make up the total to 54 gallons. Never add cold water when cooking or the resin will be precipitated, and it will be difficult to get it in solution.

3rd.—Spraying during the spring when the young scales are hatching out and when they are tender and easily killed with the resin and soda wash recommended in the case of the woolly aphis. The spraying should be repeated several times at intervals of a week as the young scales do not all hatch out at once, and the younger they are sprayed the easier they are killed. If wished, kerosene emulsion made as follows can be used in the place of the resin and

soda wash: Take 1 gallon of best kerosene, 1 gallon of boiling water, and 8 oz. of soft soap. Dissolve the soap in the boiling water; when dissolved add the kerosene, and churn the mixture with a spray pump or syringe for fully ten minutes, so as to get the oil and the water thoroughly emulsified when the mixture becomes stable, and the oil will not separate from the water with standing, and on cooling the mixture becomes of the consistency and appearance of cream. If the oil is not thoroughly emulsified, and there is free oil present when applied, it is likely to injure the foliage if not defoliate the tree, and if free oil in quantity gets on to the roots it will probably kill the tree. For this reason it is safer to use the best kerosene in preference to blue oil, or wood-preserving oil, as the latter always contains more or less volatile oils which will not emulsify, and always destroy the foliage more or less,—though it is just as effective, if not more so, than the best kerosene. Kerosene emulsion is considerably dearer than the resin and soda wash; and if not carefully made, or if used too strong, it is apt to injure the trees. The strength at which it should be used is one part of kerosene in 15, or 20 parts of emulsion.

Greedy Scale—(Aspidiotus rapax).

This insect, though most frequently found on pear-trees and fruit, also infests the apple as well. The insects are most numerous on the smaller branches, especially at joints and on fruit spurs, and when present in large quantities they seriously affect the growth and vigour of the tree; they also attack the fruit, confining their ravages generally to the basin surrounding the eye, so that they do not disfigure the fruit to any extent.

The remedies are the same as those recommended in the case of the mussel scale.

Ground Crickets—(Gryllus servillei).

This well-known insect often causes considerable damage to young apple-trees by eating the bark at the collar of the tree just below the surface of the ground, which, if neglected or not seen to in time, ringbarks, and consequently kills the tree. The insects also eat the bark off the limbs and devour the foliage. The best remedies to use are, first, to keep the orchard in a high state of cultivation and free from weeds, thereby destroying all shelter under which the insects would harbour; second, spraying the trees with Paris green, at a strength not exceeding 1 lb. of Paris green to 160 gallons of water, which will destroy all the insects that eat either the leaves or the bark; third, poisoning the insects by means of arsenic, as follows: Take 1 oz. of white arsenic, and 6 lb. of oatmeal or pollards, mix thoroughly and add enough treacle to make a stiff dough when kneaded; take a piece of the dough about the size of a walnut and place it under a shingle at or near the root of the tree. The insects will go under the shingle for shelter, eat the poisoned dough and die. Large numbers are easily and cheaply killed in this manner.

Red Spider.

During the winter, if the tree is carefully examined, a large number of very small round red eggs will often be noted, especially in the joints of the wood and in any roughness of the bark of the young wood. These are the eggs of the red spider, a minute insect, or rather a species of spinning mite that often does considerable damage to orchards. The young insects hatch out in spring, and often congregate in large numbers round

the stems of the fruit, sucking them and causing the fruit to fall. They also attack the foliage, and their presence may be readily detected by the silvery or greyish colour they give to the leaves. During the winter the eggs may be destroyed by spraying the trees with a strong caustic resinous wash, as recommended for scales, or the insects may be readily and easily destroyed in spring by means of the resin and soda wash. Sulphuring the trees in the early morning, when the young spiders are hatching out, is said to be a cheap and effectual remedy in California.

Harlequin Fruit Bug.

This insect often appears on apple-trees in very large numbers, especially when the fruit is ripening, and is said to cause considerable damage to the fruit by piercing the skin and obtaining nourishment from the fruit by suction. By some authorities it is considered to be the cause of the disease which is described further on, under the head of "Bitter Pit," but in this I cannot agree, neither can Dr. Cobb, our pathologist, after having made several careful investigations. That the insects pierce the fruit is absolutely certain, but that they are the immediate cause of "Bitter Pit" is exceedingly improbable.

During the winter the insects often congregate in large masses under any available shelter, when they may be easily destroyed, and at any other time they are destroyed easily by spraying with kerosene emulsion.

Various.

There are a large number of different kinds of insects that do considerable damage to apple-trees by devouring the foliage or bark or stem of the fruit, of which the following are a few of the commonest:—leaf-eating caterpillars of all kinds, leaf-eating beetles, beetles or caterpillars feeding on the skin of the fruit, grasshoppers and case moths, and for all these insects that live by actually devouring a portion of the tree there is one remedy, and that a very simple and effective one, and that is to spray the trees affected with Paris green, taking care to always use the poison with caution, as noted when treating the codlin moth.

Hares.

Hares often do considerable damage to young apple-trees, and even to trees of considerable size, by eating the bark off the trees, often completely ringing them. The best remedy, and the cheapest in the long run, is to surround the orchard with rabbit-proof netting; but where the orchardist is unable to pay for this, then the trees may be protected by smearing the trunks and lower branches with a lime-wash made from the spent lime from a tanyard, or with a mixture of blood and resin, neither of which will be touched by hares. When the tree is not entirely ruined, it may be brought round by smearing all the barked portion with fresh cow-dung, and binding a hay or straw rope round the trunk so as to protect it from the air as much as possible, when new bark will form rapidly, especially if the under bark is intact or nearly so.

Fungus Diseases.

Most of the fungus diseases of the apple having been fully dealt with in the April number of the *Agricultural Gazette* for 1892, I beg to refer any-one who is desirous of obtaining fuller information than that contained in the following condensed description of the different diseases to what was then published. All the illustrations are made from life and most of those given are reproduced from the article refered to.

Apple-scab, Tasmanian black-spot—(Fusecladium dendriticum).

Of all the various fungus diseases of the apple none is more widely distributed or the cause of more loss than the apple-scab. The disease attacks both the leaves and the fruit and its general appearance is well shown

Fig. 22.—Apple-scab on Leaves and Fruit.

in the accompanying illustration. The black spots on the fruit and leaves are covered with thousands of spores and these spores remain on the tree in a

dormant condition during the winter and on the approach of spring start into growth attacking the young leaves and fruit as soon as they make their appearance, but the fungus is not easily discernible till it has developed to a considerable extent, when it may be seen in the form of dark green patches on the leaves and of dark spots on the stems of the young fruit, which rapidly turns black and falls off. In some cases the whole crop is destroyed and the leaves are scorched and blistered almost as if by the action of fire. When not so some portion of the fruit sets, but all that is at all badly affected is contracted wherever the fungus is, and is worthless. Even where the fruit is only slightly affected its appearance is spoilt and its selling value is consequently much lessened. This disease is spreading very rapidly in this Colony, and the large amount of Tasmanian fruit affected with this disease that is now being brought into the Colony will tend to spread it very much faster, as wherever the diseased fruit goes there is a chance of its spreading the disease. Every fruit-grower should make himself thoroughly conversant with this disease, and on its making its appearance should take stringent measures to stamp it out before it has time to become firmly established and to over-run and ruin the orchard. This refers to all other fungus diseases as well, as there is a time when with a little care and attention all fungus diseases may be readily kept under, but which if neglected will allow the disease to get such a firm hold of the orchard that it will be a very difficult and often expensive job to erradicate it. The remedy for apple-scab is simple and efficacious, provided it is properly carried out, and it consists in spraying the tree with Bordeaux mixture first, just as the buds are bursting in spring, and secondly, just as the fruit is setting. These two sprayings, if properly applied, are usually sufficient as they destroy the spores of the fungus just as they are starting into growth. If, however, the two sprayings are not sufficient further sprayings may be used, using eau céleste or ammonio carbonate of copper in the place of the Bordeaux mixture, but I advise that the first two sprayings be done with Bordeaux mixture. Several other remedies are advocated but none are superior to those mentioned, and where used in this Colony the Bordeaux mixture, applied as described, has given very satisfactory results.

Bordeaux mixture is made as follows:—Take 6 lb. of sulphate of copper (bluestone), 4 lb. unslacked lime, 22 gallons water. Dissolve the 6 lb. of bluestone in 4 gallons of hot water. Dissolve 4 lb. of quick-lime in 2 gallons of water. When cool, mix and make up to 22 gallons with more water; strain and keep constantly stirred whilst using. Use good lime free from sand, and apply with a spray-pump fitted with a Nixon nozzle. If Codling Moth has to be fought, as well as scab, then the second spraying, that just as the fruit is setting, should contain Paris green in the proportion of 1 lb. of Paris green to 160 gallons of Bordeaux mixture. Used in this form the Paris green will do less harm to the foliage than when used alone, and it has also a beneficial effect as a fungicide as well as an insecticide. Eau céleste is made thus:—Copper sulphate (bluestone), 1 lb.; ammonia (strong), 1½ pints; water, 22 gallons. Dissolve the bluestone in 2 gallons of hot water. When cool, add the ammonia—add 20 gallons of water—make this mixture as wanted. And ammonio-carbonate of copper as follows:—Dissolve 3 oz. of carbonate of copper in one quart of strongest liquid ammonia, and when the chemical action has ceased add 22 gallons of water. Both eau céleste and ammonio-carbonate of copper are best applied with the triple cyclone nozzle.

Powdery Mildew (Podosphaera Kunzei, Lev.)

The presence of this fungus is readily detected in an apple orchard by a number of the branches of the trees affected having either dead tips, which are of a greyish white or black colour, or having tufts of small sized leaves covered with a thick greyish white down at their extremities; and it is from this latter characteristic that the fungus derives its name. The diseased leaves and twigs are whitish at first, but as the disease advances they become blackened, and finally the twig dies. In some instances the limbs attacked die back for the greater portion of their length, when the disease is erroneously called "fireblight," a term that is more properly applicable to scald. It is a difficult matter to make a drawing of this disease by which it may be readily identified, but the illustration of the disease drawn by the departmental artist from a specimen obtained from a winter pearmain-tree should enable any fruitgrower to distinguish the disease at once. Powdery mildew is widely distributed over the Colony, but as a rule it confines its attacks to a few varieties, the winter pearmain being especially subject to it. The remedies for the disease are to cut off and burn all diseased branches and to spray the trees when the buds are bursting in spring with Bordeaux mixture, and to follow this dressing with the ammonio-carbonate of copper, when the leaves are about half formed; this latter mixture to be repeated at intervals of 10 days as often as necessary. The recipes for making Bordeaux mixture and ammonio-carbonate of copper are given under the heading of apple scab.

Fig. 23

Bitter-Rot (Glœosporium versicolor).

This disease is also called the Ripe-Rot as it only makes its appearance when the fruit is ripening. Its appearance is very characteristic. First, it is a small, round, soft, brown spot which rapidly increases in size and varies somewhat in colour. Small pustules of a purplish colour then appear on

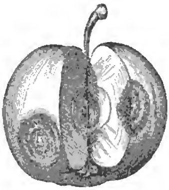


Fig. 24.—Apple, one-half natural size, attacked at two places by ripe-rot or bitter-rot. The apple is cut so as to show how the right-hand rot has penetrated towards the core. The pustules of the fungus are represented by dark spots on surface of the two rotted places.

the surface of the rot and burst, but the rot goes on spreading till the whole fruit is diseased. Early apples are usually most affected by this disease, the Irish peach being especially subject to it. The remedies are, first, to gather up and destroy all diseased fruit, and secondly, to spray, just as the fruit begins to ripen, with the ammonio-carbonate of copper, repeating the spraying at intervals of ten days as long as necessary.

Mouldy Core.

The following description of this disease I have taken from Dr. Cobb's report:—

"This is a diseased condition brought about by the presence of common mould in the core of certain varieties of apple. Outwardly such apples often appear to be quite sound, but on cutting them in halves the core is found to be in a mouldy or half rotten state. This, however, is only the

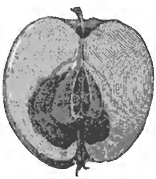


Fig. 25.—Half an apple, showing how a brown rot, due to mouldiness at the core, arises and progresses toward the surface of the apple. The rot is shown dark coloured.

beginning of the trouble, for sooner or later the whole apple becomes rotten and worthless. The rot arising from this cause has an appearance different from that of the bitter-rot, inasmuch as there are no concentrically arranged pustules, and, furthermore this rot works from the centre outward, instead of beginning as a spot on the surface and working inward.

The way in which the mould gains an entrance to the core of the apple will be seen at once if one of the diseased apples be split in halves with a sharp knife. It will be found that the blossom end is open so as to form a passage leading to the core. Ordinarily, only the varieties with open blossom ends are subject to this disease.

The remedy therefore is not to grow apples having a direct opening from the eye to the core. No other cure can be suggested. The only valuable apple that is extensively grown in this Colony that often possesses this drawback of having an open tube is the Five Crown or London Pippin, which, on account of its comparative freedom from woolly aphis, and being a good bearer and seller, is a general favourite in the colder parts of the Colony.

Bitter-Pit.

This is the name given by Dr. Cobb to an unidentified disease which is spreading rapidly in the Colony, and is very bad in several parts with certain varieties, though few, if any, apples are entirely free. The disease is easily distinguished, the fruit affected being spotted or pitted on the surface, and if the skin is removed from the spots or pits a dry spongy brown mass is

Fig. 25.

seen, which is very bitter to the taste. The disease when at all severe renders the fruit quite inedible, and even when it only causes the fruit to be slightly spotted it detracts considerably from the selling value of the fruit, as the diseased fruit will not keep—usually going dry and not rotting —the disease being altogether distinct from the "Bitter-Rot."

No remedy can be suggested for this disease, but the Department will be glad to hear if the disease is as prevalent in trees that have been sprayed for scab, bitter-rot, or powdery mildew, as in unsprayed trees.

Water-core.

When an apple instead of being quite opaque is partly or wholly transparent it is said to be affected by water-core.

There is no known remedy, and the best thing I can suggest is to refrain from growing the kinds that are most subject to it, unless, as in the case of the winter pearmain, they are of especial merit.

Canker.

This is a term that is given to a fungus that attacks both the wood and the fruit. Its appearance on the wood is easily distinguished, as it causes irregular shaped cracks with smaller cracks branching out from the main crack, and occasionally it encircles a limb or branch and completely destroys

it. Its effect on the fruit is often apt to be confounded with scab, as like scab it often cracks the fruit, but it can easily be distinguished from scab by the absence of the roundish patches and dark greenish spores of that fungus. Canker being usually much browner, rougher, and more irregular in shape. Canker is easily kept in check by pruning out and burning the worst affected branches, and by giving the tree a good coat of lime-wash which can be readily put on with a spray-pump, using a coarse nozzle. Bordeaux mixture, containing a large proportion of lime, is also equally efficacious.

Lichens and Moss.

These parasitical growths are easily destroyed by spraying with lime-wash or Bordeaux mixture.

Sun Scald.

When dealing with the pruning of the apple I pointed out the necessity of so growing the tree that the trunk is protected by the head, and also that the head of the tree is not opened out to such an extent as to permit the sun to strike directly on the bark of the branches in the centre of the tree. When the sun strikes directly on the unprotected bark of any portion of the tree it heats the bark to such a degree that the sap is over-heated and starts fermenting, the result being that either the side directly exposed to the sun is entirely killed, or the whole branch or side of the tree is destroyed, usually dying off so rapidly that it is attributed to what is usually termed "fire-blight." Even where the limb is only partially killed the tree is permanently injured, as the dead portion of the wood becomes rapidly infested with borers. In the case of young trees or of older trees that are headed high, and are of an upright habit of growth, it is a good plan to place a Hobart paling on the west side of the tree to protect it from the afternoon sun, as it is always the afternoon sun that is the most scorching, and that does the damage. Proper pruning so as to produce the necessary foliage with which to protect the branches, and to grow the branches in the right positions is the best cure for the sun-scald or "fire-blight."

Sour Sap and Scalded Roots.

Thorough drainage that will prevent the accumulation of sour or stagnant water round the roots of the trees is the best cure for this disease. And if the land is of a heavy and retentive nature as well as being sour a good dressing of not less than 2 or 3 tons of hot lime to the acre will have a very good effect.

The Vineyard and the Cellar.

By J. A. DESPEISSIS.

The Cellar.

During the month of February, preparations should be actively pushed forward for the coming vintage. The casks, vats, presses, grape-mill, &c., should be completely overhauled, scrubbed, washed out and cleansed *thoroughly* and kept in readiness—steam, hot water, washing soda, lime, hard brushes, brooms and plenty of elbow grease will assist in doing this.

The operation of racking off last season's wine for the third or the fourth time as required, should be pushed forward and as much of the older wine as possible, removed from the fermenting-house, or the air in this part of the cellar will soon be teeming with germs of fermentation which might perhaps get access to the already made wine and disturb it by starting it working again.

As it is more than likely the presses and some of the vats will have shrunk during the hot summer months, the hoops should be driven carefully and bagging soaked with water put wherever necessary on the joints, so as to enable the timber to swell and the leakage to take up.

The neglect of thoroughly disinfecting the vessels used during vintage is in many cases responsible for the ulterior damage caused to the wine by *mouldiness*, and many a well-fermented wine has been spoiled by a taste of bad cask or new wood. The wine-maker cannot therefore pay too much attention to this most important work of cleaning, and he should satisfy himself that every single utensil or vessel used for securing the new vintage has been most scrupulously cleaned, seasoned, and disinfected.

A mere scrubbing with a hard brush and water will often clean a cask temporarily, but the meshwork of mould threads which have penetrated through the pores of the wood have not been destroyed, and, a few days after a superficial cleaning, will appear as bad as ever.

Whenever such is the case the following methods of treating casks, &c., badly infected, will be found useful:—

For casks: Pour into the vessel 125 grammes of chloride of sodium dissolved in a gallon of water; for every 100 gallons of capacity of the cask (¼lb.) and a small quantity of dilute sulphuric acid—drive the bung in and let the chemical reaction set in inside the cask. Under the influence of the sulphuric acid, chlorine fumes are disengaged from the chloride of lime, and effect a complete disinfection.

This chlorine gas, however, should be removed before putting any wine into the cask, by reason of its strong irritating action on the tissues of the stomach, as well as of its pronounced bleaching action which would decolorise the wine.

For this purpose the cask is washed thoroughly by means of water, after the bung, and in the case of a large size cask, the manhole door, has been removed. A good length of sulphur match will then be burned in the cask after it has drained, the sulphur fumes neutralising completely the chloride gas. A last rinsing out, will then be effected and the cask will be ready for use.

This method, although very efficacious, requires to be applied with a certain amount of care.

Another method, which is also very efficacious and is applicable to open vats as well, consists in cleaning and scrubbing the vessel as well as possible and whitewashing it carefully inside with a limewash made of 2lb. of quicklime per 100 gallons capacity of the cask, with just sufficient water added to reduce it to the consistency of a thin paint. That limewash is left to stand for two or three days, and is then washed off. When dry, methylated spirit can rapidly be applied by means of a brush, whenever necessary, and then ignited.

The taste of wood in many cases taints what would otherwise have been good wine. It is a popular fallacy that because a cask has just been received from the cooperage establishment and made from new wood it is fit to receive wine straight away. Casks are besides unfortunately ordered at the last moment from the cooper, and very often the picking of the grapes is delayed until the arrival of the cask, accompanied by a note from the cooper that the timber has been seasoned and the cask steamed. As a matter of fact, the staves are still full of sappy and resinous matters, easily extracted by the alcohol in the wine, and will, unless removed, give to the first wine put in it an unpleasant and peculiar woody taste.

For this purpose several methods are in use. (1.) Fill the cask or vat with hot water, with 7lb. to 8lb. of common salt per 100 gallons capacity, and let stand for a day or two; then run the water out and rinse the cask well with pure water. (2.) Another method, which is even better, consists in filling the vessel with water, either cold or tepid, and adding a handful of washing soda or potash for every 50 gallons in capacity. Let stand for several days; run out the liquid, which will have extracted a brown colour out of the wood. Fill with clean water, let stand for a day or so, and run it out. If the water is not quite colourless, fill again, and run out in a day or two. Let the cask drain, sulphur lightly, and the cask is then ready for use.

Beware of swamp and stagnant water coming from holes with a lot of rotten vegetable matter in it, as it will communicate an unpleasant taste to the wine. Rain water or soft water from a clear spring or stream is the best.

Vintage is the all-engrossing preoccupation during the month of March.

In the country north of Sydney the early ripening grapes have probably been gathered by this time, but the bulk of the crop still stands unpicked. Whilst in the southern and later districts the grapes are just getting ready to be picked.

As vintage time is fast approaching, a few seasonable notes respecting that critical process of the conversion into sound, marketable wine of the produce of our vineyards will be acceptable to a great many wine-growers.

Good wine may be said to be the result of securing the presence in sound casks of good must from healthy grapes, good ferments, and a suitable temperature, &c.

Clean Casks.

I have purposely given prominence to sound casks, as I can call to memory the almost repellant and certainly unpleasant task of tasting in cellars scattered all over this country, from thousands of gallons, what would have been excellent wine if it had not been irremediably spoilt by tainted caskage.

Preparatory to vintage, and before the first grape is picked, the wine-grower should have all his caskage thoroughly overhauled, examined, rinsed out, brushed, dried, and sulphured.

Amongst the several diseases that affect wines, mouldiness and acetification can in almost every case be traced back to dirty and tainted casks—and acetification, lactic fermentation, ropiness to defective fermentation.

In every case of disease of wine, it may be said, prevention is easy, and cure very often beyond practicable reach.

It is surprising how few know how to clean a cask. Super-heated steam, of course, stands foremost as regards expeditiousness, whenever it is handy.*

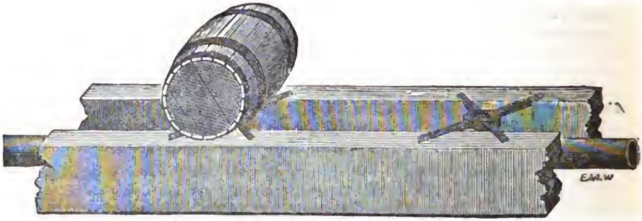


Fig. 1.—A simple cask-steaming apparatus is here shown, and consists of iron crosses fixed to wood bearers; a steam pipe runs along between the bearers, with a nozzle fixed in the centre of the cross. The cock is placed with the bunghole over the nozzle, and steam admitted, which cleanses the cask.

The following method, too, I have always advised, and whenever it has been practised not a gallon of wine was ever tainted through bad caskage—viz:—

The cask having been emptied, either after the operation of racking, or say on its delivery from the hands of the cooper—if a big cask with a door to it a man gets in, if the cask is very dirty a couple of bucketsful of water are thrown into it, and with a straw broom, the cask is well washed all round and the dirty water swept out into a tub left standing under the man-hole to collect it—a couple of bucketsful of hot water with a couple of handsful of washing soda, for a 500 gallon cask or a little more for a 1,000 gallon vessel, are thrown into it—with a hard brush—I have found cask brushes I purposely got out and made of steel wires and hard, coarse fibre invaluable for the purpose and of splendid wear—both heads and the interior of the cask all round are then throughly scrubbed. By the time the operation is finished, the water is very dirty and as black as ink; this dark wash is swept out of the cask and two fresh bucketsful of hot water and soda are thrown in, the

N.B.—For a more general dissertation upon the question of wine fermentation. our readers will please refer to a paper from Mr. J. A. Despeissis published in the *Agricultural Gazette* of N.S.W., Vol. II., Pt. 6.

operation of scrubbing being repeated—the wash having been swept out into the tub in front of the man-hole, a couple bucketsful of clean cold water are thrown in and the cask well swept out with a straw broom dipped in the water —the operation is finished by swirling water all round the interior of the cask by means of a tin dipper. This water is then got out and the man comes out of his steamy cask, looking as if he was fresh from a Turkish bath. The next day, when the cask is dry (which is important) a sulphur rag is burnt in it—the door screwed on and the plug driven in. This sulphuring should be repeated every two months or so, should the cask be left empty—should the cask be wet at the time of sulphuring hydrogen sulphide would be produced which would impart to the wine an abominable smell.

When the cask is mouldy or smells sour, which should seldom if ever occur in a properly conducted cellar, a good swabbing of the cask with a solution of sulphuric acid in ten to fifteen times its weight in water, after the first rinsing out with water and prior to the scrubbing with the hot water and soda, will, in the majority of cases, restore a slightly-tainted cask to soundness. This practice I invariably follow, whenever I receive new casks from outside, and I feel justified by results in recommending it. For other methods of cleansing and disinfecting mouldy casks I would refer to the notes for the month of February.

Good Must.

The next point of importance is good must. This I will pass over lightly as, owing to the favourable climatic conditions which are met with in this country, whenever the choicer varieties of wine grapes grown are brought to the cellar the must is, when the grapes have been well tended, of such a quality as in almost every case to make good wine. To those vine-growers who have on hand a large stock of wine difficult to sell, I would strongly urge the gradual elimination from their vineyards of all except the choicest varieties of vines so as to raise in years to come the standard of excellence of their wine. To those about to plant, judicious consideration before planting will be found advisable. Good red wine made of the Shiraz, Carbinet, Malbec, Verdot and Pineau grapes will always sell and command a paying price. Amongst white wines the Keisling, Verdeilho, Tokay and Aucarot, will produce a wine that will sell readily. Brown Muscat of Frontignan, in those districts like the Murray, which are warm and dry, yields a paying crop.

Good Ferments

Are another factor of good wine, and after all the light thrown on this obscure question of alcoholic fermentation of late, the wine-maker has no longer any excuse for abandoning the fermenting vats to the capricious invasion of any particular ferments or germs that choose to invade it and take upon themselves the task of splitting up the grape sugar in the must into spirit and other products excreted from their microscopic bodies.

Although wine-making dates much farther back in the history of civilization than either the more modern industries of brewing or distilling, yet, as regards the common sense practice of fermentation, the brewer and the distiller may be shown up as an example to imitate to the more antiquated wine-maker.

No vat freshly filled with mash is ever allowed to start fermenting of its own accord in a well-conducted brewery or distillery, and similarly in wine-making, it is to be hoped, this vintage will sound the death knell of so-called "spontaneous" fermentation in the cellars of our progressive wine-makers.

Before filling up the first vat or cask, a small amount of mother ferment or yeast should be on hand, and this is easily prepared.

A couple of days before vintage proper begins, some sound, ripe grapes should be picked, brought to the cellar, crushed, and partly stemmed, as on the stalks lay a large number of useful yeast cells, which are the active agents of fermentation.

The must is then pressed out, if "white" wine is the object in view, or left with the skins for the making of "red" wine; this must be placed in a clean cask, with the head taken off and left in some cool corner, at a temperature of 25° to 30°C. (76°–86°F.), where fermentation will soon set in. When the first bubbles of gas show that the process has manifested itself, no time should be lost in picking, crushing, and filling with grapes the larger fermenting vats, and as the process of filling goes on, a bucket full of that mother liquor in full fermentation is every now and again scattered over the mass of the freshly crushed grapes.

The objects of conducting wine fermentation may be said to be manifold, and especially in a hot country are often the means of warding off the possible invasion of acetic or lactic ferments.

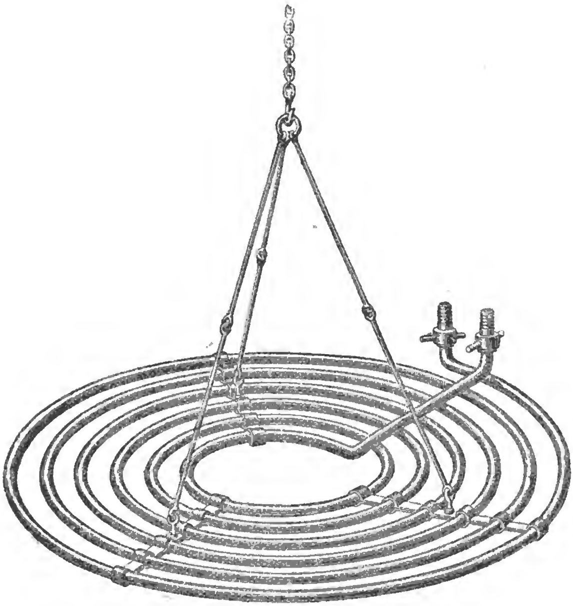
Of late years the deep clouds that shrouded the whole matter of fermentation have been dispelled by the progressive investigations conducted in the laboratory; that most inquisitive instrument the microscope has revealed the size and shape of the various organised bodies that are the active agents of fermentation, and the thermometer, supplementing the researches of the chemist, has defined to a nicety, the temperature at which each form of these micro-organisms found in crushed grape-juice thrive best, so that by controlling the temperature you are enabled to favour the one and check the other. Thus it has been found that the most suitable temperature for fermenting wine lies between 70° to 90°F. (21° to 33°C.). In the vinegar factory the temperature most suitable for turning alcohol into vinegar extends between 80° to 100°F. (26° to 38°C.), and the wholesale druggist who has a large order for lactic acid, carefully maintains the temperature of his spirituous liquor to even a higher temperature, ranging between 100° to 110°F. (38° to 42°C.). Armed with these facts, the brewer or the wine maker must strive to check the excess of temperature in his vats, to conduct wine making on the road to fermentation without interruption, and in as short a space of time as possible, so as to round the dangerous corner where these highwaymen—acetic acid on the one side, lactic acid on the other—are both lurking in the dark, ready to annex the wholesome spirit drawn out of the grape sugar by alcoholic ferment, and thus rob the wine grower of hard-earned reward, and the consumer of the mild stimulant that will nerve his flagging spirits or brace up his worn-out system, or manifest its way out again in bubbles of good humour.

To this end the use of an attemporator is much to be recommended. This apparatus, of which several designs are used in breweries, butter factories, &c., is, in this instance, for regulating the temperature of liquids when undergoing fermentation, and consist of a continuous run of tinned copper-pipe.

The above is a very simple and convenient form of portable copper attemporator, consisting of a flat, circular coil to suit the shape of the vat, of tinned copper-pipes $\frac{1}{16}$ of an inch thick, and 1 in. to $1\frac{1}{4}$ in. outside diameter, with supporting stays and suspending rods, by which it may be hung in the vat at any desired height. The pipes are fitted with unions for connecting india-rubber hose for the supply of cooling water. When required to be

removed after fermentation for cleaning purposes it is readily hoisted up by pulley-blocks out of the vat. The pipes are set at a distance of about 4 inches between, so as to allow rapid and thorough cleaning.

Amongst other advantages, this attemporator is easy to construct cheap, can be fitted up anywhere, being simply hung on a beam on the top of any vat. It is by means of the pully blocks and a counterpoise hitched on at



g. 2.

the other end of the chain, set at any depth in the fermenting wine. A good depth, I have found, is about 6 inches below the surface, as it is well known that fermentation, and hence development of heat, is more active at the top of the vat than at the bottom. The liquid on being cooled has besides a tendency to sink, and thus maintain amongst the lower layer of the fermenting must, a moderate degree of temperature.

For the purpose of working the attemporator, an abundant supply of cool water is necessary, and this can be pumped to a tank placed at a higher level than the attemporator itself, from a well, an underground tank, or even a cool stream. By means of a tap fitted on the supplying overhead tank the flow of the cooling water can be regulated so as to maintain the suitable degree of temperature in the vat.

In practice, 3 to 4 square inches of surface piping are allowed per gallon of liquor to be cooled. This would be, with water at from 65° to 70° F. Supposing an attemporator is required for an 800 gallon vat. Such a vat would not receive more than about 600 gallons of grape must. One linear foot of copper pipe 1 inch outside diameter, would represent 36 square inches of cooling surface, reckoning that the circle bears to the diameter the proportion of 3 to 1. This would be sufficient for cooling 9 to 10 gallons of liquor; for 100 gallons we would require 10 feet, and for 600 gallons, a coil of 60 feet of 1 inch piping.

Supposing a pipe of $1\frac{1}{4}$ inch outside diameter is used, 1 linear foot of such piping would maintain 14 gallons of must at a temperature below 90° F. with water, say, at 68° F., and a coil made of a 43 feet pipe, would control the temperature of 600 gallons of grape must. The cost of such attemporators, with all fittings complete and ready for use, would amount to about £6 to £8.

The first question that arises in wine making is—should the grapes be stalked previous to fermentation? In the majority of cases in the making of red wine stalking is to be recommended, as there is little in the stalk that enters into the compostion of wine.

By the operation of stalking besides, a better aeration of the must results, as the bunches of grapes are vigorously tossed about during the process and the skins being rent asunder, previous to the mangling of the berries between the rollers of the grape mill.

Stalks in a small proportion in the mass of grape pulps are, to a certain degree beneficial, as they keep it porous and prevent it settling into too compact a body, thus giving facilities to both the air and the liquid in fermentation to penetrate it; by this means more colouring matter is extracted and renewed activity given to the ferments which are generally found in greater abundance on the grape stalks.

We thus see that the first process of wine making proper consists in separating the stalks from the skins and to aërate the must as energetically as possible.

Pasteur has demonstrated that one of the main factors of the maturing of the wine is the oxygen, which its constituents hold either in solution, or in a state of loose chemical combination. As in the case of wine, so it is with grape juice, and it may be said that, by the aëration of the must, the process of maturing of the grape is consummated in the vat and the must enriched by the fullest amount of the fermentable grape sugar it is susceptible of developing. The aëration of the must involves other phenomena besides, which will be lightly touched upon presently.

The second question that presents itself is—should the fermentation be conducted in closed or in open vessels? The skins and caps kept immersed in the must, or left to float by their own buoyancy?

Under this heading will be considered the advisability of insuring:

1st.—A maceration of the skins sufficiently prolonged to effect in a full measure its beneficial effect in wine making, but not so lengthened as to communicate to the wine a stalky or "earthy" taste.

2nd.—Complete alcoholic fermentation all through the mass of the must and at every point of the fermenting vat.

To these ends, the following simple method of treating the must to be turned into wine which I have seen attended with the best results, I commend to the attention of wine growers.

The grape pulp is conveyed in the ordinary ways, provided in each individual cellar, from the grape mill to the fermenting vat, which can well be an open one and should not be too deep, but rather shallow, and in this hot climate, not too capacious, viz., from 400 to 600 gallons preferably.

During this operation of filling up, a stright tap about ¾ of an inch to 1 inch inside diameter, driven in the plug hole at the base of the vat is left open so that as the must and pulp fall from the grape mill, the liquid must is allowed to run out into a tub placed under the tap for the purpose of receiving it. In order to avoid clogging and obstruction at the tap by the pulp, it is a good practice to nail together two 6-inch boards about the

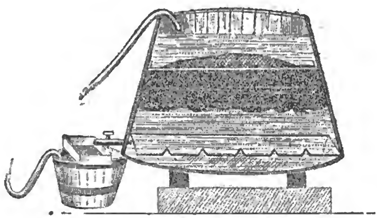


Fig. 3.

length of the bottom of the vat and V shaped. This sort of gutter is inverted with its edge uppermost from the top, across the diameter of the bottom of the vat. This will secure a free space for the must to drain from the pulp, and should the tap get clogged it can easily be removed, and a thin rod or a thick piece of wire poked through the plug hole along this V shaped gutter, so as to remove any possible obstruction.

This appliance is set fast at the bottom of the vat by means of a wedge driven in at the end diametrically opposite to the outlet or tap end. A few notches cut off its edges as well as the V shaped stays that help to keep the boards solidly together will allow the liquid to get underneath and run out through the tap into the tub provided for receiving it, while at the same time excluding the crushed berries and grape skins.

The liquid must in the tub is pumped provisionally into another empty vat or cask, and when the first vat is about one-third full of grape skins, the crushed grapes from the mill are directed towards some other empty vats. At this stage a man is sent down the vat last filled, to equalise the volume of the skins and fasten to hooks provided inside the vat and driven in at distances of 18 to 24 inches a strong net with ¾-inch meshes, so as to prevent the marc from floating and forming a cap on the top of the liquid in fermentation.

On this spongy mass of grapes freshly crushed are scattered a few bucketsful of must in full fermentation, from the tub set fermenting as already described, or from a vat already in fermentation.

Under the combined influence of the temperature of the fermenting house and on this crushed well-aërated mass, the newly added ferments soon take a hold of the contents of the vat, and within a very few hours fermentation

is in full swing. The liquid must collected separately is then pumped back on the top of this spongy fermenting mass, and the conversion of grape juice into wine thus sets it at once and goes on regularly and rapidly.

A few hours after the violent fermentation has set in, and instead of the old fashioned trampling down of the cap floating on the surface of the must in the vat, the plug at the bottom is knocked off and the fermenting must allowed to run through a strong sieve into a tub placed underneath. From this tub the liquid is pumped back on to the top of the vat. Care should be taken to screw the rose on to the suction hose, so as to ward against any skin or pips getting into the valves of the pump and putting them out of order.

This pumping may be said to be attended with several results:—

1st.—It is one of the most practicable means we have in the wine cellar of maintaining an even and moderate temperature inside the fermenting vat. The difference between the must at the bottom of the vat is sometimes 8 degrees to 10 degrees lower than that at the top, which often reaches the critical temperature at which acetic and lactic ferments thrive best. By thus pouring it on the surface an even and moderate temperature is maintained, and the predominance of alcoholic ferments over injurious ferments thus insured.

2nd.—The grape sugar, which, by a more advanced fermentation decreases at the top of the vat is more evenly distributed and fermentation goes on more briskly.

3rd.—In heavy must or must rich in nitrogenous compounds which are almost an element of danger, the energy of the yeast is increased by the process of aëration and the nitrogenous compounds precipitated by the action of the oxygen of the air on their elements.

For a vat of moderate dimensions, pumping for about half an hour and twice a day, will be found sufficient. By this means a complete circulation of the must will take place in the vat, through the mass of emerged skins or marc, and the colouring matter thus steeped in a tepid liquid will be easily washed off, and impart to the newly made wine the rich ruby colour which so much gladdens the eye of wine drinkers.

To sum up this improved method of wine fermentation it is seen that the period of fermentation is made as short as possible; the temperature is not allowed to rise beyond 92 degrees to 95 degrees F. Acetic and lactic ferments have less chance of tainting the wine. Earthy tastes, often due to prolonged maceration of the marc in the wine, disappear; the colour of the wine is deeper; the process of fermentation being more rapid, fewer vats will answer for vintaging any given quantity of grapes as compared with the present system of fermenting, which means less capital invested in fermenting vessels; and most important of all a better type of wine will be turned out, which will possess better keeping qualities, and when marketed command a better price.

On the Choice and Use of Artificial Manures.

By F. B. Guthrie.

Composition and Action of Manures.

We have now to consider the composition and the specific action of the several substances used as manures; and for this purpose it will be convenient to classify them according, as lime, phosphoric acid, nitrogen, or potash is their dominant constituent. The manures which depend for their action upon the presence of lime are burnt lime, carbonate of lime, and gypsum.

Burnt lime or quicklime is obtained by burning limestone (carbonate of lime) in kilns of special construction. Limestone is a compound containing lime and carbonic acid. In the process of burning or calcining, carbonic acid and water are driven off, and the burnt product is pure lime (calcium oxide) of greater or less purity according to the purity of the original stone. Other substances having the same composition as limestone also yield lime on being burnt such as chalk, marble, shells, &c. If the lime has been properly burnt it forms a very hard stony substance nearly white, which slakes, or combines with water, with great avidity, crumbling to a fine white powder and evolving sufficient heat to convert a part of the water into steam. In slaking it combines with water, and slaked lime is a hydrate of lime. As its function in the soil is principally mechanical, a test of its goodness lies in the readiness and completeness with which it slakes. Both under-burnt and over-burnt lime slake badly, though from different causes. The quantity to be applied to the soil varies according to the character of the soil. Unlike most of the manurial substances we shall have to consider, its action consists in improving the character of the soil rather than in acting as a direct plant-food. It is applied in quantities varying from half-a-ton to four tons per acre every six or seven years,—heavy clay lands requiring the larger dressing. It is best to break it up into small lumps, and place it in heaps about the field, covered with moist loam, leaving it exposed to the air and moisture for a short time—say about twenty-four hours—until it begins to crumble to powder. As soon as this happens, scatter the heaps with a shovel as evenly as possible over the surface of the field, and harrow or plough in lightly. Liming is most effectively done in the autumn or winter; but whenever it is done, the land should be left alone for quite three weeks after the application, and no seed should be sown, nor any nitrogenous manure added during that period.

The action of lime is in the first place a mechanical one, in altering the texture of the soil and with it those properties which depend upon its texture, such as its absorptive power for water, its amenability to tillage

operations, &c. If a small quantity of a heavy clay be mixed with water in any suitable vessel it will form a muddy liquid. If a little lime be added to this and the mixture well shaken, it will be noticed that the solid matters sink to the bottom in a loose powder, and, in a short space of time if the water is poured off and the soil dried, it can be readily broken up by the fingers. This action, which is due to the power that the lime has of coagulating the fine particles of the clay, is identical with what takes place on the larger scale when lime is added to the field. The presence of lime also prevents the shrinkage which wet clay-soils undergo on drying, and which causes the cracks and fissures seen on the parched clay-soil. The admixture of lime to a clay therefore prevents the formation of a sticky mass when wet, and a cracked parched appearance when dry.

On light sandy soils the action of lime is also strikingly beneficial in binding the particles of sand together, and increasing the cohesive and capillary power of the soil. Its action is in fact, exactly that of lime on sand in the mixing of mortars, only on a much modified scale, since for making mortar the proportions are one part of lime to three or four parts of sand, whereas the addition of a ton of lime per acre represents one part of lime to nearly 20,000 parts of sand. The action of the lime is the same in both cases, on drying it absorbs carbonic acid from the air, forming carbonate of lime, which cements the particles of sand together, forming, in the proportions used in making mortar, a hard compact mass, and in the case of the soil, increasing its cohesiveness and its power of retaining water. Lime, therefore, lessens the cohesiveness of clay soils, and increases that of sandy soils, two properties which are apparently opposed to one another. In fact, there are few soils, the mechanical texture of which is not improved by the addition of lime.

The action of slaked lime is exactly the same as that of stone, or quick-lime but not so pronounced, and it is generally preferable to use the lime unslaked, or only slightly slaked, as recommended above. Apart from the above mechanical property of lime in improving the texture of the soil, it has also a chemical action and though this is not thoroughly understood it may be classed under the following headings:—

First, it neutralises the free acids sometimes present in soils. Sour soils contain free acids present in such quantity as to be injurious to plant life and such soils are "sweetened" by the application of lime, that is to say, the free humic and similar acids are neutralised.

Secondly, it attacks the inert organic matters in the soil and promotes fermentation, one of the most active agents in the production of available plant-food. It is of course possible to have too much of a good thing, and an excessive dressing of lime would tend to burn up the vegetable matter of the soil and do as much harm as good, but in the moderate dressings above recommended it will be found beneficial even on land which has lately been green-manured. It must not be forgotten also that the action due to caustic-lime soon ceases, for it is very rapidly converted into carbonate of lime within the soil, which has no such action on organic matter. The danger therefore, of the addition of lime destroying the organic matter of the soil, is a bogey.

Thirdly, it attacks the insoluble mineral constituents of the soil to some extent. This is notably the case with potash, which being a weaker base than lime is set free from its insoluble compounds such as felspar, and rendered available as plant-food. Phosphoric-acid also enters into combination with lime, and is in this form more readily utilised by the plant than in its insoluble combinations with iron and alumina, with which it is associated in the soil.

Fourthly, carbonate of lime (into which we have seen the lime is soon converted in the soil) is beneficial, if not necessary to the process of nitrification, the peculiar ferment action by which the inert soil-nitrogen is converted into nitrates.

Fifthly, whilst it promotes certain ferment action such as the above, it hinders the active growth of many fungoid diseases like rust and smut, and is often a cure for such diseases.

Carbonate of lime, or as it is sometimes called "mild lime" is unburned limestone or shells crushed. Its addition to the soil promotes fermentation and nitrification, prevents clay lands from puddling, and in short has much the same action on the soil as lime has, except where such action depends upon the conversion of lime into carbonate. It is milder in its action, and as a rule, burnt lime is to be preferred.

Gypsum or plaster is also a substance that may be sometimes used to advantage. Its action consists almost solely in setting free potash, hence it is most useful on soils rich in potash, and for such crops as clover it is of especial service. It is best applied moist or in wet weather at the rate of 2 to 3 cwt. per acre. Gypsum is also often used as a "fixer," that is to say, when added to dung or urine or decaying animal and vegetable matter it decomposes the carbonate of ammonia which is being continually evolved from such substance and converts it into sulphate of ammonia, in which form ammonia does not escape into the air. If a heap of dung from which the odour of ammonia is perceptible be mixed with a few shovelsfull of moist gypsum, the smell will be found to have disappeared, in other words the ammonia is "fixed" and its loss prevented.

Manures Containing Phosphoric Acid.

Phosphoric acid is applied to the soil almost exclusively in the form of phosphate of lime, and its sources are bones, rock-phosphates, and guanos. In the apparent absence of any large quantities of phosphatic rocks in our continent, we are principally dependent for our supply of phosphate of lime on the bones of animals. Bones vary very slightly in composition from whatever source they are drawn, or from whatever part of the animal they are taken, though as a rule the thigh-bones and the bones that have to bear the greatest mechanical strain, are the richest in phosphate of lime. Bones are composed chemically of water, ossein or collagen, fat and mineral salts. The last-named, which are left behind as ash when the bones are burnt, consist principally of phosphate of lime. Bone-ash contains about 83 per cent. of this substance, together with about 10 per cent. carbonate of lime, and in much smaller quantities magnesium compounds, and fluoride and chloride of calcium.

The ossein of the bones is the substance which is converted into gelatine by boiling with water, and is an albumenoid containing about 16 per cent. nitrogen. Bones are therefore a nitrogenous as well as a phosphatic manure. An average sample reduced to powder as bone-meal, contains about 45 per cent. phosphate of lime, and a trifle under 4 per cent. nitrogen.

Bones are used in a variety of ways. They may be used whole, or broken, or reduced to powder (as bone-meal, bone-dust, or ground bones), they may be boiled, or steamed, or fermented; calcined (bone-ash), charred (bone-black), or converted into superphosphate.

We will now see how these different methods of treatment affect their composition and action.

When simply broken or crushed their chemical composition is, of course, unaltered, and the principal advantage derived from their finer mechanical condition is the greater rapidity of their action. Whole bones resist decomposition within the soil for a considerable length of time, and it is very doubtful if their use is in any sense economical. In fact, as the object of artificial manuring is to feed the crop rather than the soil, it is doubtful whether slow-acting manures are in any case economical. The case of lime, which we have just considered, stands on a different footing. Lime is seldom applied as a direct plant-food. Its action is practically confined to the soil. The substances we have now to consider are valuable only when they are available as plant-food; they produce little or no permanent benefit to the soil, and if their decomposition is slow the plant receives its nourishment in small driblets, inadequate to its needs.

Bones are therefore most efficacious when crushed, and within certain limits, the finer the powder the better the product as a manure. An additional advantage of fineness of division lies in the ease and evenness with which it can be distributed on the land, or mixed with other manures.

Bone-meal is decomposed in the earth, the nitrogen in the ossein being converted by putrefaction into ammonia, and the phosphate of lime rendered soluble by the action of carbonic acid and the vegetable acids. It is particularly suited to turnips and root-crops generally, grass, tobacco, fruit-trees, and in fact is a manure of almost universal application. It is applied at the rate of from 3 to 5 cwt. per acre, and if mixed with a manure containing potash, forms a complete manure, and is an excellent substitute for stable manure. It is more particularly adapted to light soils, and is sometimes disappointing on heavy clays, the probable reason for which is that in stiff clay soils it is more or less protected from putrefaction (which we have seen is the cause of its efficacy) by the absence of air and moisture.

Boiled or steamed bones or bone-meal.

When bones or bone-meal are boiled, and more effectually when they are subjected to steam, the ossein of the bone is gelatinized, and more or less removed, whilst the fat is also removed, the resulting compound being therefore poorer in nitrogen, but richer in phosphoric acid. The treatment renders them more friable, and they are easily reduced to fine powder. The removal of the fatty matter also renders them more easily decomposed in the soil, as fresh bones are more or less protected from external action by the presence of the fat. The proportion of phosphoric acid is therefore not only increased, but its rapidity of action and consequent effectiveness as a manure is increased, at the expense of course of the nitrogen, which may be reduced 1 or 2 per cent., as the accompanying table will show:—

Fermented Bones.

Bones may be decomposed and rendered more active by mixing them with about one-fourth of their weight of clay, and keeping the heap moist with stable-liquor or urine. The heap should be protected from rain. By this process also there is a loss of nitrogen, but the phosphate is rendered more readily available and proportionately increased. This is a method that deserves to be made use of where bones are plenty, and there is no means of reducing them to powder. Thirty to forty bushels per acre is the proportion recommended for grass lands.

Bone-ash.—The residue left after the calcination of bones consists, as we have seen, mainly of phosphate of lime, and contains no nitrogen. It is not largely used as a manure, its principal application being in the manufacture of superphosphate. It is dissolved in the soil by carbonic acid, and conveyed thus directly to the plant.

Bone-black is the product of charring bones. The broken bones are subjected to strong heat in closed iron cylinders, whereby they are converted into bone-charcoal, on exactly the same principle that wood is converted into wood-charcoal. The volatile matter of the bones is driven off in the form of gas, water, oil, and tar, and the carbon present is for the most part left mixed as charcoal with the mineral matter of the bones. This product is largely used by sugar-refiners for removing the colouring matter from raw syrups. After it has been used for this purpose a certain number of times, it becomes unserviceable, and can be obtained at a cheap rate for manurial purposes. It may be applied directly to the soil as a phosphatic manure, or better converted into superphosphate by treatment with acid. This substance is the basis of the manures manufactured by the Colonial Sugar Company.

Bone-black by itself is a purely phosphatic manure, containing only a very small proportion of nitrogen. The charcoal present has no fertilising value, and it is slightly poorer in phosphate of lime than bone-ash. It is, however, worthy of consideration as a manure on account of the low price at which it can be obtained.

The following table shows the alteration in composition which bones undergo when subjected to the above methods of treatment. The analyses are for the most part taken from Griffiths' work on manures, and are not analyses of the same sample, but represent fairly the composition of the several products. The analyses of bone-black was kindly supplied by Mr. Walton of the Sugar Company, and represents their "char," after it has been used for the purposes of refining.

	Bone-meal.	Boiled bones.	Steamed boned meal.	Fermented bones.	Bone-ash.	Fresh Bone-charcoal.	Spent Charcoal.
Water	10·43	10·61	11·57	12·02	1·86	......	2·
*Organic matter, including 10% carbon in the case of charcoal ...	32·30	21·55	19·01	28·71	......	13·5	18·
Calcium phosphate ...	48·40	60·19	60·02	49·28	86·34	76·0	74·
Calcium carbonate alkalies, &c.	7·20	5·81	8·54	8·92	11·29	7·0	5·5
Insoluble	1·67	1·84	0·86	1·07	0·51	1·0	1·5
	100·	100·	100·	100·	100·	......	......
*Containing nitrogen ...	3·71	1·76	1·60	3·47	......	0·7	0·7

Chemical Notes.

By F. B. GUTHRIE.

Wood-ashes as a Fertiliser.

The value of wood-ashes as a fertilising material is not as widely known as it deserves to be. In newly-cleared country this valuable substance is produced in large quantities, and it will be found to more than repay the trouble of returning to the land. It is a matter of common observation that after a bush-fire the vegetation is particularly strong and luxurious, and the effect is due entirely to the lime, potash, and phosphoric acid thus returned to the soil. The household fires also furnish a small but continual supply of ashes which should all be kept and made use of. They may be utilised, either by themselves, or mixed with other manures, or added to the compost-heap, a valuable adjunct to the economy of the farm.

The ash of the different woods contains the mineral portion of the wood from which it has been obtained. Of these ingredients the bodies possessing fertilising value are lime, potash, and phosphoric acids. Their potash and phosphoric acids are, moreover, in an exceedingly soluble condition, and are in such state as to be readily assimilated by most plants. The value of the ash of the different varieties of European trees has been long well known and their constitution established by numerous exact analyses. The composition of the ash of our own trees has not as yet been studied, but from the following analyses made in the Department, it will be seen that they are likely to be quite as valuable. I hope soon to be able to lay before you the results of a larger number.

	Phosphoric Acid.	Potash.
Spotted gum	·10	·69
Red gum	·38	4·17
Bloodwood	·80	1·50
Box...	·68	1·68
Blackbutt	·04	2·02

The analysis of blackbutt is due to Dr. Helms.

The process of burning converts the potash salts into carbonate of potash for the most part, the lime is present in the form of oxide and carbonate, and the phosphoric acid partly as calcium phosphate, and partly as alkaline phosphates. Now carbonate of potash and alkaline phosphates are particularly soluble forms of potash and phosphoric acid respectively, the beneficial action of lime, both in the form of oxide (quicklime) and of carbonate (chalk) is well known. It will, therefore, readily be seen what

a valuable manurial substance we have got here. In addition to their direct action as plant-food, wood-ashes act beneficially in improving the quality of stiff clay-lands, and equally so in binding light sandy soils. In fact, they benefit the soil mechanically exactly in the same way that lime does. With the exception of nitrogen which, of course, has been burnt off, they contain all the ingredients of a complete manure, and in a particularly serviceable form. It might, therefore, be expected that the addition of a nitrogenous manure would make a complete manure of them. But such addition must be made with great caution, as the presence of free lime and alkalies in the wood-ashes are liable to decompose the nitrogen in such a mixture, driving it off in the form of ammonia, the smell of which will be apparent when sulphate of ammonium and wood-ashes are mixed together.

The ash of young wood is especially rich in potash, and generally speaking, the ash of young and small wood, as young boughs, twigs, &c., is more valuable than that obtained from the trunk or heart of an old tree.

The following are the best methods of utilising wood-ashes:—

They may be used alone as a top-dressing to grass and pasture, and for leguminous plants, but they are of benefit to nearly all crops, potatoes and roots, fruit and vines, being specially benefited. They are applied at the rate of from 25 to 30 bushels per acre.

A mixture of wood-ashes and bone-meal in the proportion of 5 cwt. bone-meal to 25 bushels ashes is said to be an excellent substitute for farmyard manure. Such a mixture should be made as it is required, and not kept mixed.

Instead of mixing superphosphate with loam or earth when applying it to the land, it may be advantageously mixed with three or four times its weight of wood-ashes. But the best way of utilising wood-ashes is the compost-heap.

The best material with which to compost it is undoubtedly peat, but other decayed or decaying vegetable matter is nearly as good, such as straw, old leaves, twigs, and refuse of this sort generally. Such substances are fermented by the action of wood-ashes and their nitrogen rendered available. The most convenient from of the compost-heap will vary on different farms, and the subject is so wide and important that it will be more properly discussed in a chapter to itself. On farms where the compost-heap is an institution, it should not be forgotten that the addition of wood-ashes forms the best method of utilising this product and improves the value of the compost-heap. Where such a system of utilization of waste matter is not practised, the following method of composting ashes will be found useful:—

Make a heap of alternate layers of peat or peaty loam, or vegetable refuse and wood-ashes, or make a hole and fill it with these substances in alternate layers, moisten the heap with urine or slop-water, and allow to ferment for a few months, when it may be turned over. The addition of stable-manure, dung, and in fact all refuse-matter of the farm will benefit such a heap, which may be thus made the means of utilising a great deal of valuable fertilising material which would otherwise be thrown away.

The above remarks apply to unleached ashes, such as are obtained from the burning of timber.

Leached ashes contain practically little but lime and carbonate of lime, as the potash and phosphoric acid are for the most part leached out. Their use and action are similar to those described under the heading of carbonate of lime. They may be sometimes economically used instead of this substance, but in no case will the farmer derive any benefit from leaching his own ashes.

Australian Honey.

The following notes on the constitution of a few samples of commercial honey and of honey obtained from well known apiaries may be found of interest to bee-keepers.

Of five samples of commercial honey examined, three were undoubtedly adulterated with starch, syrup—or glucose. The following table gives the polarimeter readings and the percentage of glucose, water, and ash in eleven samples.

	Water.	Ash.	Direct Reading Sugar scale.	Reading after inversion.	Glucose by copper.	Glucose after inversion for three hours at 100°C.
1. Commercial (adulterated)	20·0	·32	+65·12	+61·12	52	76·6
2. Commercial (adulterated)	21·33	·27	+14·32	+ 7·37	64	76
3. Commercial (adulterated)	19·50	·26	+130·3	+119·8	50	80
4. Commercial	21·0	·10	—26·6	— 28	74	
5. Commercial	26·18	·14	—11·7	— 12·1	69·4	
6. Honey from apiary of Mr. W. H. Moore (Singleton).	23·02	·21	—17	— 19·5	71·4	
7. Mr. Walker (Tenterfield), bees fed on white clover.	19·18	·06	— 9·1	— 15·6	71·02	
8. Mr. W. Abram (Beecroft), bees fed on mixed flowers.	25·29	·16	—23	— 23	72·46	
9. Mr. W. Abram (Beecroft), bees fed on orange blossom.	26·33	·20	—23	— 23	72·45	
10. Mr. A. E. Taylor (Cowra)... ...	23·23	·04	—24·2	— 27·3	73	
11. Mr. Worrell (Baulkham Hills) ...	24·34	·35	—20·8	— 21·6	68·6	

The polarimeter readings were always taken at the same temperature before and after inversion and the temperature is taken into account in the percentage calculations in the second table.

At the risk of introducing technical terms I will briefly explain the bearing of some of these observations. This will save time and trouble later on, and will enable those who care to follow this work to understand future notes on the subject.

Honey consists principally of a mixture of two sugars, dextrose and levulose. A solution of dextrose observed in the polarimeter rotates the polarised ray to the right, levulose to the left. Levulose, however, turns the ray nearly twice as far to the left as dextrose does to the right, consequently a mixture containing equal parts of these sugars will exhibit a left-handed rotation, and this left-

handed or levo-rotation will be observed if there is any considerable quantity of levulose present. Now, cane-sugar is also a somewhat doubtful constituent of honey. This substance is strongly dextro-rotatory; but after inversion, that is, after having been boiled with acids for a certain time, it is converted into a mixture of dextrose and levulose in nearly equal proportions, and becomes in consequence levo-rotatory. Hence, in comparing the figures in columns 3 and 4 in the above table, any increase in the angle towards the left is attributed to the inversion of cane-sugar, and any adulteration with cane-sugar may be detected by this means.

Our knowledge of the composition of honey is very unsatisfactory; but it is reasonable to suppose that it consists essentially of these two sugars, dextrose and levulose, together with a very variable proportion of cane-sugar, and of 1 to 4 per cent. of substances whose nature is unknown.

The most reliable observations of pure honey would seem to establish the fact that pure honey, except under exceptional circumstances, is levo-rotatory, and it will be seen that all the honeys in the above table of known origin are levo-rotatory. Now, the substances with which honey is most likely to be adulterated are starch-syrup or cane-sugar. Glucose obtained from starch exhibits a strong right-handed rotation, consisting as it does of maltose, and dextrin. Cane-sugar we have seen is also dextro-rotatory, consequently we may regard a honey exhibiting a strong right-handed rotation as having received the addition of one of these substances. One other technical point and I have done. The sugars, dextrose and levulose, have the power of reducing alkaline solutions of copper. This gives rise to the figures in column 5, which give the total percentages of these sugars. Maltose possesses this power to a less degree and dextrin not at all. After inversion for three hours at 100° C. (see column 6), dextrin and maltose are converted completely into dextrose, and hence the higher percentage of glucose in column 6 is due to the presence of dextrin and maltose.

If we now examine our table in the light of the above data, we notice that the first three honeys all show a strong dextro-rotatory reading. They all, moreover, yield a precipitate of dextrin on the addition of alcohol. The high-reading of No. 3 excludes the possibility of there being any levulose present. It is simply starch-syrup or American glucose, with a slight flavouring of honey. Nos. 1 and 2 probably contain genuine honey, together with a considerable addition of starch-syrup. The composition both of pure honey and of starch-syrup are so variable that it is not easy to state dogmatically the amount of such admixture which in the case of No. 1 is probably considerably over 20 per cent., and in No. 2 over 10 per cent.

The above facts suggest the probability that the bulk of the so-called honey in the market is largely adulterated, and it is to be hoped that the bee-keepers of New South Wales will be able to see their way to protect themselves against such practices.

The remaining honeys, Nos. 4 and 5, give the same readings as genuine honey, and there is no reason to doubt their genuineness. No. 5 has granulated (dextrose has crystallized out), which is an additional indication of its purity. No. 4 is somewhat more strongly levo-rotatory than the samples of genuine honey, but not strikingly so, and is not unlike Mr. Taylor's honey. If invert-sugar is used as an adulterant, the reading will be more strongly levo-rotatory; but as honey is to all intents an invert-sugar, the estimation of this substance would be a very difficult matter in the present state of our knowledge, provided the mixer were ordinarily judicious. The higher price of invert-sugar fortunately renders its use extremely unlikely.

The following table shows the approximate composition of the genuine honeys examined, including the two commercial samples, and are calculated from the readings given above, on the assumption that honey consists mainly of dextrose and levulose, with cane-sugar.

Percentage composition of genuine honeys.

	Water at 110° C.	Ash.	Dextrose.	Levulose.	Cane-sugar.	Unknown.
No. 4	21·0	·10	36·2	38·4	1·03	3·27
No. 5	26·18	·14	39·0	30·4	?	4·28
No. 6	23·02	·29	37·0	34·4	1·8	3·51
No. 7	19·18	·06	39·12	31·9	4·8	4·94
No. 8	25·29	·16	36·15	36·3	0	2·09
No. 9	26·33	·20	36·16	36·3	0	1·02
No. 10	23·23	·04	34·6	38·4	2·3	1·43
No. 11	24·34	·35	33·5	34·1	?	7·71

None of these honeys gave any indication of dextrin by the test applied, and they were all granulated or have granulated on keeping. I have to express my indebtedness to Mr. Helms for the samples of genuine honey, obtained through the courtesy of the gentlemen named; and to Messrs. Walton and Steel, of the Colonial Sugar Refining Company, for several useful hints as to working and calculation.

Report on the Administration of Diseased Animals and Meat Act.

THE Under Secretary for Finance and Trade,—

Board of Health Offices, Sydney, 6 December, 1893.

Sir,

I have the honor, by direction of the Board of Health, to submit herewith a report on the administration of the "Diseased Animals and Meat Act" for the year 31st March, 1893.

This Act was assented to by the Governor on the 16th March, 1892, but prior to that date the Board had caused to be made inspections of animals sent for sale at Sydney and various country markets, and a large number found to be diseased were promptly destroyed, the owners as a rule offering no objection. The Mayor of Sydney also took similar action in the interests of the public health.

In making the preliminary arrangements for administering the Act the Board determined to utilise as far as possible the services of officers then in the employment of the Government and of the different municipal councils, and to this end authorised, in accordance with the powers given them by the fifth section, Government Medical Officers, Inspectors of Stock, Municipal Inspectors, Police Inspectors of Slaughter-houses, and other police officials to inspect and seize animals under the Act. Thus some 700 inspectors were appointed throughout the Colony without additional cost.

It is, however, to be regretted that some of the Municipal Councils which were invited to submit the name of one of their officers for appointment failed, and in several instances absolutely refused, to do so. As the Act is a measure passed in the interests of the public, it is only reasonable to expect that municipal authorities would cheerfully assist the Board in safeguarding the health of their particular districts.

At the same time the full services of the Government Veterinarian (Mr. Edward Stanley, F.R.C.V.S.) which were formerly divided between the Health Department and the Stock Branch of the Mines Department, were secured for this Board—the only actually new appointment being that of a Veterinary Inspector (Mr. S. T. D. Symons, M.R.C.V.S.). In this way the expense of administering the Act has not exceeded the sum of £1,000 per annum.

Returns have been supplied by the various inspectors, and from the figures furnished it appears that the following animals have been seized and dealt with during the year under review :—

District.	Cattle.	Pigs.	Sheep.	Calves.	Rabbits.
Metropolitan	994	450	14	2	675
Country	936	57	9	......	......
Total	1,930	507	23	2	675

In addition to the above, portions of unwholesome, unsound, or diseased beef, mutton, veal, and pork carcases, and putrid bacon have been seized and condemned.

Prosecutions have also been instituted against persons for selling or consigning diseased animals, both in Sydney and the country districts, and in nearly every instance convictions have been obtained, and fines inflicted. A large number of diseased cattle, apparently ownerless, and found straying on public lands, highways, reserves, &c., have been seized and dealt with under the sixth section, and are included in the figures given in the foregoing return.

The veterinary officers of the Board have visited many parts of the Colony from time to time, and afforded valuable instruction to authorised persons as to their duties, and also have given simple directions for the detection of diseased beasts, but in all seizures the authorised persons acting therein have been directed to secure professional aid to support them, either from the local Government Medical Officer, or a competent and qualified veterinary surgeon.

During the year inquiries were made by European Governments, through the Secretary of State for the Colonies, as to the condition of the meat exported from this Colony, and in one instance a very large firm of London shippers instructed their agents in this city to procure certificates from veterinary inspectors as to the condition of the cargoes. This Board, however, with their limited staff, found it impossible, to make minute inspection of every frozen carcase leaving port, and, instead of this, furnished information to the Governments concerned respecting the Act now in operation for the prevention of slaughtering of diseased animals for food, and, on the assurance that the provisions of the Act were stringently administered by the Board, no similar requests have been subsequently made, and thus shippers are saved from a considerable expense, and the important export trade assisted, whilst the home consumer is protected.

Requests have been received from two Associations connected with the sale of stock in the city that all animals about to be sold at the various metropolitan markets should be inspected by the Board's officers prior to being offered for sale, in order that the sellers might be protected from committing possible breaches of the Act. The Board could not see their way to accede to these requests, it being no part of the duties of the Department to inspect stock previous to sale for the benefit of persons trafficking therein, and the Associations were informed that in the opinion of the Board such persons should take steps on their own behalf to prevent any infringement of the law, the departmental inspectors, however, attend

all sales regularly, and should any diseased cattle be presented for sale they are duly seized, but beyond this the administration of this very useful measure would be impeded.

Much opposition to the Act was displayed at its initiation by various persons connected with the breeding and sale of stock, and it was found necessary, in addition to the seizure and destruction of diseased animals, to institute proceedings for the recovery of penalties, in order that their responsibility in this matter might be brought home to graziers. As the provisions of the Act became more known it was realised that the trade generally would benefit by its strict enforcement, and that ultimately the flocks and herds of the Colony would be considerably improved. In no case, however, has the Board ordered any prosecution, except where the disease was external and clearly observable by any person with an ordinary knowledge of stock.

Applications have been made from time to time for permission to travel diseased stock to boiling-down works in various parts of the country; but the Board, whilst of the opinion that the boiling down of diseased animals was desirable, were not in a position to grant the necessary permits, as by the 6th section of the Act any diseased animals found in a public place, or on a highway, road, &c., are to seized and condemned. Further it appeared to the Board that to permit the travelling of diseased cattle to boiling-down works would be to expose to grave danger from contagion the herds of stockowners resident in the vicinity of the route taken.

The administration of the Act raised many points of scientific interest and pratical importance, to settle which it became necessary to undertake microscopical and experimental investigations, chiefly in the Board's laboratory. The results of much of this work are contained in the appendices to this report, and go far to show what diseases prevail amongst stock in this Colony, and to give an estimate of the proportion in which they affect the stock. It would thus appear that amongst 155 specimens collected indiscriminately from animals condemned as unfit for food, no less than 116 or 75 per cent., were found to be tuberculosis, thus at once justifying the action now being taken to prevent such animals passing into the food supply of the people.

The Board may be permitted to draw special attention to the investigations on the "Worm nests in beef" (App. 2) and on "Pants" or "heaves" a disease in pigs, one variety of which corresponds to "Coast cough" in cattle and consumption in man. But the investigation showed that there, was another and much more contagious variety due to a specific organism the recognition of which and the determination of its virulent character led to the disease due to it being placed on the list of contagious diseases under the Act. Coloured figures of the characteristic appearances are appended hereto. The organism—a bacterium—has been isolated and cultivated in a pure condition, and the experiments performed with the pure culture leave no doubt whatever that it is the cause of the more contagious variety of "pants." The losses occasioned by the ravages of this disease have been enormous, but it is hoped that the recognition of its nature and the prompt destruction of affected animals—the only remedy at present known—will lead to a great diminution in its prevalence.

I have, &c.,

EDMUND SAGER,

Secretary.

APPENDIX No. 1.

Re Microscopical examinations of Animal Diseases, by Mr. Pound.

Board of Health Offices, 127 Macquarie-street,
Sydney, 22nd May, 1893.

Sir,

I have the honor to report that during the three months Mr. Pound has been engaged on the above work, I have been able to secure 155 morbid specimens, taken fresh. from animals condemned as being unfit for food.

The specimens were collected indiscriminately, from the sale-yards, markets, and abattoirs.

The results are very satisfactory, proving the correctness of diagnosis made by the officers whose duty it is to condemn diseased animals or carcases, and also supports the action being taken by the Board, under the Diseased Animals and Meat Act.

As I have taken great interest in watching Mr. Pounds work, and have examined every preparation, I may be permitted to say much credit is due to him for his patient persverance in determining, and demonstrating the specific micro-organisms; it involved an immense amount of labour, often from one to two dozen preparations had to be made from a single specimen before definite results could be obtained.

To the naked eye, a clinical comparison of the morbid specimens proved over and over again that to judge by histological appearances is most misleading and unreliable, as the results of disease so closely simulate each other, although originating from very different causes.

The following is a summary of the examinations :—

Diseases.	Cattle.		Swine.	Totals
	Males.	Females.		
	78	33		
Tubercle	111		5	116
Actinomycosis...	18		...	18
Abcesses	13		...	13
Cancerous	1		2	3
Dermoid	2		...	2
Pneumonia, contagious	...		3	3
				155

From the above table it will be seen that about 75 per cent. were cases of tuberculosis, and a large proportion were bullocks.

In 109 cases, Koch's bacilli were unmistakeably demonstrated. The diseased parts, were sometimes pieces of lung, more often lymphatic glands in a nodular and caseous stage, and sometimes grapy tubercles from serous membranes.

Actinomycosis was usually in the maxillary region, one in the muscular tissue of the tongue, one in a suppurating femoral abcess. Mycelium was much more frequently found than clubs.

Of the abcesses, seven were acute, containing streptococci or other bacteria. The others were chronic. These abscesses resembled tumours, were taken from the face, neck, brisket, flank, lungs, kidneys, liver.

The cancerous cases were epithelioma from a cow's vulva. A sarcoma and a fibroma from pigs neck. Two dermoid cysts from the necks of cattle, externally resembled tubercles (carcases were passed for food.) I attach a report by Mr. Pound.

I have, &c.,
EDWARD STANLEY, F.R.C.V.S.,
Government Veterinarian.

E. Sager, Esq., Secretary, Board of Health.

"Diseased Animals and Meat Act."

Board of Health Offices, 127 Macquarie-street,
Sydney, 22nd May, 1893.

Sir,

I have the honor to submit to you a report which embodies the results of an investigation carried out in accordance with your instructions to determine the nature of various manifestations of diseases in animals condemned and destroyed under the above Act.

From 17th February to 16th May inclusively the Government Veterinarian secured specimens of diseased tissues and organs from 155 animals killed at the abattoirs and saleyards, such specimens being taken indiscriminately.

As soon as convenient after each animal was killed the morbid material was placed in a stoppered bottle containing 50 per cent. alcohol, with a label affixed bearing the date and necessary remarks.

Several specimens were obtained from different animals suffering from suppurating abscesses, a few on the flank. These flank abscesses, which are somewhat uncommon in cattle, bearing a striking resemblance to one another, so much so that it is almost impossible to diagnose them from their naked eye appearances. Their true nature can only be determined by resorting to various complicated processes of staining, and the use of the microscope with high power objectives. With these means at hand, I have been able to clearly differentiate these abscesses into three distinct varieties, viz. :—

Actinomycotic, in which the fungus appeared in the young active mycelium stage.

Tubercular, by the presence of tubercle bacilli, although very sparsely distributed.

And acute suppurating, which contained either the streptococcus pyogenes or the staphylococcus pyogenes aureus.

Taking any of these superficial abscesses from other parts of the body, if I failed to find either tubercle or actinomycosis. I was always successful in demonstrating the presence of some variety of pyogenic bacteria.

Very compact nodular growths are frequently noticed in the neighbourhood of the jaws in cattle; they vary considerably in size from that of a pin's head to an orange or even larger; in some cases they remain intact, while others have a tendency to break down and suppurate; they are situated sometimes in the subcutaneous tissue, frequently in and around the jawbones, but more rarely in the muscular tissue.

On examining six of these cases from the region of the upper and lower jaws, I found the actinomyces in nearly every stage represented in the life history of the organism, from the development of the spores to the actively-growing filaments, from the mycelium to the club-shaped bodies which ultimately undergo degeneration and calcification.

One specimen taken from the inferior maxilla of an ox consisted of a chain of little nodules, each of about the size of a pea, and firmly embedded in the muscular tissue. In structure they consisted of a dense mass of calcareous matter surrounded by a very thin wall of fibrous tissue. Failing to find anything of a tubercular nature, specimens were stained and examined for actinomycosis, but without success, although every known available method was used, and it was only when some of the calcareous material was treated with hydrochloric acid that I found a few clubs in a degenerative stage undergoing calcification. This manifestation of actinomycosis, which was undoubtedly undergoing spontaneous recovery, points out one of the many difficulties encountered diagnosing this disease.

It is interesting to note that two animals each having a tumour just under the skin in the region of the parotid gland, and which felt like and resembled tubercle or actinomycosis, proved after the animals were killed on final examination to be typical examples of dermoid cysts, otherwise these animals were in a perfectly normal condition, and, although they were not condemned, are sufficiently interesting to be noted.

I wish to draw attention to the fact that several cases of tuberculosis submitted for examination from the abattoirs were taken from dry milch cows. The specimens consisted of portions of the lungs, liver, and various lymphatic glands, and in each case presented the appearance of a chronic and long-standing form of the disease, the lungs and glands being a solid mass of caseating and gritty tubercular deposit, while tubercle bacilli wereextremely numerous.

A number of cases of bovine tubercle presented itself in the "grapy" or "perlsucht" form of the disease, while a few lung cases of tubercle in the early stage were found associated with the old lesions of pleuro-pneumonia.

By using the same staining reagents throughout of series of specimens under precisely the same conditions, I found that the tubercle bacilli varied very considerably in size and manner in which the stain was taken up. Some of the bacilli appeared very long and distinctly beaded, in others the beading was absent, others again were very short and fat, while some took the stain very readily, others were more resistant. In some specimens the bacilli were very numerous and frequently found in giant cells, while in others difficulty was experienced in even finding one or two in a dozen preparations.

Only one case of true bovine cancer was submitted for examination, that being an epithelioma from a cow's vagina.

On examining specimens from two pigs, one was found to be a "mixed cell sarcoma,' the other a fibroma.

Specimens were secured from eight pigs suffering from lung disease ; on examination, five of these were tuberculosis, while in the remainder, which were cases of contageous pneumonia, I found the specific micro-organism.

In some specimens of tuberculosis in which the tubercle bacilli were not found owing to their sparse distribution, it was necessary to rely on the histological characters, but this only occurred in seven cases out of 116.

TABLE showing results of microscopical examination.

Diseases.	Cattle.	Pigs.	——
Tuberculosis	....	....	116
(Histologically)	7	....	....
(Bacilli found)	109	5	....
Actinomycosis	....	....	18
Abcesses	....	....	13
(Histologically)	6	....	....
(Pyogenic organisms found)	7	....	....
Epithelioma...	1	....	1
Sarcoma	....	2	2
Contageous pneumonia	....	3	3
Dermoid cysts	2	....	2

Total number of cases 155

This investigation adds materially to our present knowledge of the nature of diseases in cattle and pigs, also to what extent tuberculosis and actinomycosis is prevalent among cattle. Further, it points out how readily, in some instances, one disease may be mistaken for another when judged by the microscopical appearances only, and when such diaguosis is uusatisfactory, only a microscopical examination can bring about the desired result.

I have, &c.,

Edmund Sager, Esq., Secretary, Board of Health. C. J. POUND.

APPENDIX No. 2.

NODULAR TUMOURS.

Worm Nests in Beef.

Sir, Sydney, 3 March, 1893.

I have the honor to report having noticed small tumours, like marbles, on the brisket, under the skin, and in the deeper layers of cellular tissue and fat, more commonly seen in this region, but they are occasionally seen in other parts of the body, sometimes so numerous as to be mistaken for tubercular nodules. Butchers call them white kernels, so distinguishing them from the brown-coloured lymphatic glands.

On cutting them open they are found to be firm and whitish in colour, but in the spring they are yellowish and drier and contain distinct calcareous worm casts. They rarely soften or excite suppuration.

They are made up of dense fibrous tissue, in which namatode (round) worms are intertwined. I have only been able to extract pieces of the worms, and find they contain ova and also living little worms. Some of them are free, some coiled up in the ova cells. They probably belong to the variety spiroptera. A similar parasite is found in nests in the stomach of the horse.

These nodular tumours are not at all uncommon, and are possibly harmless to the meat consumer. I have, however, advised the Meat Inspectors to have them cut out, as they are unpleasant to the sight, and may suggest other diseases to the uninitiated.

I forward a few specimens of the tumours in bottle marked D, in order that they may be examined and identified.

The following is Dr. Gibson's report on the specimens :—

"*Specimen D.*—Three tumours from brisket of a fat bullock from the Abattoirs, February, 1892.—This is a very interesting, and, in my opinion, important specimen.

The tumours were rounded or ovoid in shape, the largest being about the size of a large bean. Sections of the largest showed a somewhat kidney-shaped outline, with a dense fibrous looking capsule, measuring about the $\frac{1}{12}$ of an inch in thickness. Passing in from this capsule were numerous trabeculæ, of varying thicknesses, which interlaced to form a meshwork, enclosing spaces of different shapes and sizes, which communicated freely with each other. These spaces were mostly empty in sections cut on the freezing microtome, but in some of them could be seen parts of the contained parasite, cut in various directions.

Microscopically.—Examining the outer margin of the fibrous capsule, one finds that it is ragged and ill-defined, showing that it had not been entirely isolated from the surrounding structures. The tissue of this capsule was composed of dense fibrous tissue in some places, and of fibro-cellular tissue in others. It was very abundantly supplied by blood-vessels, many of which were embryonic in character. Young nematode embryos, in large numbers, were seen in some parts of this capsule, some bent double, others coiled up in figure of 8 fashion, and others stretched full length. Some appeared to be in the channel of a small blood-vessel, ready to be carried along the general circulation. The structure of the trabeculæ was somewhat more cellular than that of the capsule, and the blood-vessels were more embryonic. Some of these blood-vessels were in very close relation to the enclosed spaces. Numerous nematode embryos occupied certain parts of the trabecular mesh-work.

The above-mentioned spaces were occupied by adult nematode worms. Unfortunately, I have been quite unable to procure a complete specimen of the adult worm, partly because of the hardening in absolute alcohol, and partly on account of the complex mesh-work surrounding the worm. Even very cautious efforts at pulling served to rupture the parasite, so that a very imperfect description can be given. The parasites were adult females, resembling in structure ordinary nematodes. The uterus contained fully-formed embryos, as well as ova in all stages of development. As may be seen on examining slide D2, which is part of an adult parasite, the embryos are in enormous numbers in the uterine cavity. Although I am unable to give proper measurements of the adult parasites, or even to state whether one, or more than one, is present in each of the three tumours. I have taken very careful measurements of the embryos. These latter average $\frac{1}{100}$ of an inch in length, and $\frac{1}{3000}$ of an inch in breadth. They have a slightly bulbous head, with a circular, discoid, cephalic extremity, whilst the tail is frequently curved, and invariably tapers to a fine point. There was no sac observed surrounding the embryos, such as has been described in the case of the embryos of *filaria sanguinis hominis.* The contents of these embryos were slightly granular, but there were no organs visible in the interior.

In my opinion, these tumours, containing the adult nematode worms, with their embryos, may be regarded as so-called "worm-nests," or "worm-knots," which are not unfrequently found in the lungs of sheep, and rabbits and oxen. The parasites which form these "worm-knots" are said to belong to the strongylidæ; but some species of *filaria* also form "worm-knots." In this case, although the adult parasites appeared to be encapsuled, it is important to remember that the embryos which had become free had, in some cases, gained access to the blood-vessels, and it is not too much to imagine that numbers of them were circulating in the blood-stream. Important questions present themselves for consideration in this connection, especially the question of the probability of human infection from eating the under-cooked meat of the animals so affected. The complete life-history of the *filaria sanguinis hominis* has not as yet, to my knowledge, been satisfactorily wrought out.

The measurements of the filaria-like embryos in this case do not correspond to those which Lewis gives as the average for *filaria sanguinis hominis.* He gives the average length as $\frac{1}{75}$ of an inch, and the breadth as $\frac{1}{3500}$ of an inch. But it must be remembered that his measurements were taken from embryos which were alive and circulating in the blood-stream, whilst those which I give were from embryos either recently escaped from their parent or actually present in the uterine cavity, and, therefore, more immature. Moreover, my specimens were hardened in absolute alcohol, which would cause a certain amount of shrinking. As regards the absence of the tubular sac surrounding the embryos in this specimen, too much weight must not be attached to that, because after death the *filaria sanguinis hominis* may occupy the entire length of the sac, and so render it invisible, or may be found contracted within the sac so as to leave the latter visible at one or both extremities.

Without being able to determine definitely the actual species of parasite present in this case, sufficient has been stated to warrant careful consideration as to the treatment of the flesh of animals affected with these so-called "worm-knots" or "worm-nests."

Dr. Gibson also read a paper on the subject at the Medical Congress in September, 1892. *See* the Transactions of the Third Session.

See slides D1 and D2, stained with picro-carmine.

As nodular parasitic diseases are sometimes mistaken for tuberculosis, it may be well to point out that they are met with in various animals, and may be found in many parts of the body, and are often due to migration of the worms from the digestive organs. They are found in the stomach and bowels of horses, in the lungs and bowels of sheep, and are known to butchers' assistants who prepare sausage-skins as knotty guts, and are discarded in consequence, being useless, as they easily tear from brittleness.

I have seen clusters of the worm nodules so excite the nutrition of the parts as to become the seat of tuberculosis, and have found the tubercle bacilli in such places, but such an occurrence is purely accidental, as it is well known that tubercle will easily become established in the seat of any injured tissue when the subject of the injury is already in a tuberculosis condition.

It will, therefore, be apparent that worm nest or parasitic worm nodules should not be mistaken for either tubercles or cancers.

I have, &c.,
EDWD. STANLEY,
Government Veterinarian.

APPENDIX No. 3.

Swine Diseases.

Tuberculosis and Contagious Pneumonia.

Board of Health Offices, 127, Macquarie-street,
Sydney, 18 February, 1893.

Sir,

I have the honor to submit a review of the investigations carried on to determine the nature of the disease in pigs known as "pants" or "heaves."

In a report dated 25th May, 1890, on a visit of inspection to the South Coast District, where I had noticed the prevalence of tuberculosis in cattle, the Board of Health instituted an investigation in order to ascertain the prevalence and nature of "coast cough" in that district, which proved, on microscopical examination, to be bovine tuberculosis (*vide* report presented to Parliament on the 9th October, 1890.) I drew attention to the disease, locally known as "pants" or "heaves," which I saw in the swine piggeries attached to a slaughtering-place, and at two butter-factories.

Post-mortem examinations revealed the pathogenic aspects of tuberculosis in several cases; in others the pathology was new and indefinite.

In order to investigate the subject, I arranged for a supply of diseased pigs. These were kept at Rodd Island, and, in conjunction with Mons. Loir, a series of experiments were carried out during the year 1891.

We obtained at different intervals twelve diseased pigs. The symptoms of illness were noted, *post-mortem* examinations made, and inoculations carried out on twelve guinea-pigs and seventeen rabbits.

On 16th June, 1891 (3,242), a preliminary report by Mons. Loir and myself expresses uncertainty as to the existence of tuberculosis, and suggesting the idea of a disease due to a specific bacillus.

On 5th December, 1891 (6,712), being dissatisfied with the progress of the investigations, I reported (See Appendix A) on a pig that had been ill and under observation for a month, the *post-mortem* examination giving pathogenic indications of tuberculosis. Specimens of the diseased parts were submitted by the Board of Health to Dr. John Gibson, of Windsor, for histological and microscopic examination.

On 12th January, 1892 (253), Dr. Gibson reported this case to be "tubercular broncho-pneumonia," and he suggested inoculations, he not knowing that experiments had been in progress for twelve months.

On 2nd April, 1892 (1,675), I reported on experiments. Mons. Loir having returned to France about Christmas, I determined to inoculate bovine tubercle virus, in order to compare the results with the disease "pants."

I experimented on two healthy pigs and two guinea-pigs, in every case being successful in producing tuberculosis.

The disease was confirmed by Mr. W. Scott, Veterinary Surgeon, 17th March, 1892 (2,050), and by Dr. Gibson (see his report, dated 19th April, 1892).

On 9th February, 1892, I obtained specimens of disease lung and lymphatic glands, having the pathological lesions of tubercle from pigs slaughtered and condemned at the Abattoirs. These were submitted to Dr. Gibson for examination; also specimens from the tuberculous guinea-pigs.

From his report, dated 29th March, 1892 (2,330), he found tubercle in each case.

During the year 1892 I lost no opportunity of gaining information about the diseases in swine, making *post-mortem* examinations, and collecting morbid specimens from various

localities, thus securing valuable material for further examinations; and, finally, this year, the Board of Health has secured the services of Mr. Charles J. Pound, a practical bacteriological laboratory assistant. He has enabled me to confirm my original diagnosis of the disease "pants," that it is of a tuberculous nature, and in some cases identical with tuberculosis (coast cough) in cattle, and with phthisis or consumption in mankind.

We have also demonstrated that swine have another lung disease, with all the symptoms of "pants." This is much more fatal than tuberculosis, and may be named "contagious pneumonia of swine." It will be found fully described further on.

Mr. Pound has demonstrated, by histological preparations, tuberculosis in eleven cases, and successfully stained the bacilli in seven of these.

Contagious pneumonia he demonstrated in four cases, and the somewhat intractable bacteria are well illustrated in each.

The pneumonia specimens were obtained from different localities, namely, Enfield, Riverstone, and Jamberoo.

I have found both these diseases existing in the same herd, but I have not found the two diseases in the same pig.

History of the Diseases and their Distribution.

The disease "pants" has been known to swine dealers for the last thirty years. In 1889 I found contagious pneumonia at a piggery in the Mittagong district; it was very fatal, and *post-mortem* examination revealed no tubercles, but extensive consolidation of the lungs.

In 1890 I saw both diseases at milk-factories and slaughtering-places on the South Coast.

In 1892 the Bodalla Company lost 60 per cent. out of a herd of 222 Bega pigs from the "pants" (contagious pneumonia). Wet weather and travelling, perhaps, increased the mortality.

For Liverpool Asylum twenty-five pigs were purchased in May, 1892. Five days later, contagious pneumonia ("pants") broke out; deaths occurred twenty-four hours after being taken ill, others lingered for a week; altogether, seventeen died, and the rest were killed to prevent the spread of infection to the other piggeries.

During my inspection of the metropolitan slaughtering-places in 1892, I found a few pigs affected with pants, on ten out of twenty-five slaughtering-places. The butchers always viewed it as a calamity, and believed it to be a necessary evil and a loss incident to the trade, quite beyond their control. They stated that it was usually fatal, but a few recovered. According to their accounts, the losses are very variable, and uncertain. This is easily understood, now that we know they may have been affected with tuberculosis, which is a slow-going chronic disease, or they may have suffered from contagious pneumonia, a disease much more virulent, and speedily fatal.

I found both diseases in the large swine herds (where several hundreds of pigs are kept together at Riverstone and at Enfield; also in the Hunter River District at Aberdeen. Contagious pneumonia was introduced in April, 1892, to the extensive piggeries there, by a herd of two hundred and forty pigs sent in lots from Sydney. The majority of these died in two or three weeks. The disease spread to the old stock of pigs, but was less fatal; 50 per cent. died.

The losses were so heavy that at the Aberdeen works pig-farming has been found unprofitable, and has been discontinued.

In order to allay unnecessary alarm by this report of disease in swine, I may mention that the inspection of pork at the Abattoirs during last year was energetically carried out, with the result that while many pigs have been condemned as unfit for food, I wish it to be specially noted that on comparison the percentage of diseased pigs was only about half as high as that of cattle condemned, out of the total number of animals killed for food, as beef and pork.

Remedial Measures.

Now that the pathology of "pants" is known, and its virulent character understood, it is not difficult to deal with.

If contagious pneumonia breaks out, kill every panting and coughing pig at once; the first loss will be the least, so stamp it out.

If tuberculosis is in the herd, treat every panting and coughing pig the same, destroy them. A tuberculosis pig never completely recovers; he is a source of dangerous infection to his fellows; the disease is hereditary, contagious, and incurable; he is useless to breed, and is condemned as pork; therefore there is only one remedy—stamp out the disease. By keeping a few convalescents about the germs of the disease are disseminated, and the herd will never be sound. Burn or bury deeply the carcases.

Tuberculosis or Consumption in Pigs.

Pigs are more susceptible to tuberculosis than cattle ; it is usually found where large numbers of pigs are kept together ; it is hereditary, and spreads by contagion, through the expectorations during attacks of coughing ; it is readily communicated by inoculation, and more often assumes a chronic than an acute form, so that it is often noticed that a consumptive pig may continue coughing and panting for months, and even grow and get fat.

Tuberculosis is a nodular disease affecting the lungs, liver, glands, and internal organs ; it is specially noticeable by little grannles, called miliary tubercles, on the serous membranes, in the lungs, and in the lymphatic glands. The miliary tubercules are very numerous, and often coalesce, forming nodules and nodular masses. These nodules press on the capillary blood vessels, so cut off nutrition, then caseation begins and abscesses form. These, in chronic cases, become cheesy, and even calcareous.

In swine (also in cattle) we find the glands of the throat particularly liable to undergo degeneration, and form tubercular purulent abscesses, full of creamy matter, which very rarely escapes through the skin, in consequence of its density.

Symptoms of Tuberculosis.

These are subacute and intermittent, a chronic cough, that may last for weeks or months, the pig growing and feeding while the disease is slowly progressing. Both the cough and panting breathing are easily excited by exertion. The appetite is not often interfered with until the disease is firmly established. Then they cease to thrive, waste away, cough badly, have diarrhœa, sometimes paralysis, and then die.

Pathology of Tuberculosis.

The distribution and stage of development of the tubercular deposits will vary in every case examined. Sometimes they are very numerous, and in others scarce, and may even be found in one region or organ only.

Serous membrances lining the chest or the abdomen are frequently studded with gray and yellow miliary deposits.

Lungs are always affected, with either recently-developed miliary tubercles, small suppurating nodules, or patches of consolidation, with points of abscesses, and occasionally with pleurisy and adhesion.

Lymphatic glands—bronchial, maxillary, mesenteric, &c.—are much swollen, with characteristic irregular surfaces, from projecting nodules, in some glands breaking down, becoming purulent, caseous, or calcareous.

Spleen is rarely much affected, only a few scattered nodules being found.

Kidneys.—Tubercular deposits are rarely seen.

Liver.—Usually contains a few scattered nodules. These are frequently purulent. In rare cases this organ is extensively tuberculous.

Cirrhosis is often seen in pigs.

Intestines.—These are sometimes adherent from subacute peritonitis, associated with advanced mesenteric tubercles. The mucous membrane is not often affected.

Koch's bacillus is demonstrated in swine tuberculosis, thus proving the true nature of the disease.

The pathological histology is described in Dr. Gibson's report, dated 13th January 1891.

Contagious Pneumonia.

Symptoms.—These closely resemble tuberculosis, but this disease is much more rapid in its progress, and spreads through the herd. The pigs are more suddenly and severely ill, and die in from two to twenty days after taking the infection, the death-rate being from 60 to 75 per cent.

As the disease is located in the lungs, the respiration is obstructed, causing the short panting breathing, from which the name "pants" has been derived. There is a painful cough, fever, excessive thirst, loss of appetite, weakness, inability to move about, and finally, paralysis and death.

Pathology.

The microsopical appearance of the lungs at first sight resembles pulmonary tuberculosis ; the bronchial and other lymphatic glands, especially those of the cervical and maxillary region, are usually involved ; both pleuritic and peritoneal adhesions and effusions accompany this disease. The lungs show extensive consolidation or carnification. It commences in the apices, spreading throughout the smaller lobes ; portions of both lungs are usually affected, and in fatal cases it involves nearly the whole of both

lungs. There is more or less congestion in the sounder parts; the consolidated patches are somewhat nodular, carnified, and gelatinous, the margins being clearly defined, but with very broken irregular outlines, the carnified parts being made up of clusters of solid lobuli. These are mapped out, giving a typical appearance; in colour pale grayish or yellow where caseous, with here and there a few densely-congested deep-red hepatized lobules; the inter-lobular septa are distinct as gray lines, bearing a striking miniature resemblance to contagious pleuro-pneumonia in cattle.

There is a granular appearance (not unlike the miliary tubercles); these are the little points of abscesses occurring in the nodules which undergo caseous degeneration comparatively early in this disease, but the little nodules are not diffused throughout the lung tissue, as is seen in the miliary stage of tuberculosis.

The affected parts are often, but not always, pleuritic, with recent adhesions to the ribs, and some effusion of fibrinous lymph. On section the lobules are seen distinctly marked out by the thickened septa; some are congested; many are solid, with infiltrated lymph; others are caseous; on looking closely minute vomicæ are seen, and little abscesses are plentiful. On pressure, a mico-purulent material exudes, the small bronchial tubes are found obliterated, the larger bronchials are congested and full of frothy mucus.

The bronchial glands are much swollen, spongy, and soft, from accumulated lymph-cells; often undergoing caseous degeneration. The surfaces and contour of these glands are even and free from nodules, and, therefore, unlike tubercle.

The abdominal organs and serous membranes are free from granular or nodular growths.

Pathological Histology.

By the Gram method, with carmine, and very patient manipulation, Mr. Pound has succeeded in demonstrating myriads of bacteria, shaped like grains of rice, single, and in short chains and very minute, invading the lung tissues, and most numerous in the early stages of the disease processes.

These bacteria are probably the *materiesmorbi* of this disease, and their presence accounts for the army of leucocytes surrounding the nodules; the bacteria are very plentiful in the centre of the nodules, especially where they are becoming purulent (they resemble Fraenkel's pneumo-cocus). He also found the pus organism streptococcus pyogenes, and apparently also other organisms.

Sections stained show extensive areas of consolidation, due to excessive cell proliferation, accumulations of leucocytes, which readily retain carmine dye; whereas tubercle lung, examined by the same method, at the same time, similar cells, stain faintly, and are so pale as to be almost indistinct. These cells are in dense masses, invading the alveoli, dilating them, and by pressure reducing the walls, which are much atrophied and indistinct; these alveolar walls are very clearly seen in tubercle.

The interlobular septa are much thickened by increase of fibrous tissue. The lueocytes appear to squeeze the little bronchi out of shape, invade the submucous membrane, break up and destroy the calumnar epithelium and crowd into the tubes and air vesicles.

Hœmorrhagic spots are well seen on the margins of the nodules. Vomicæ and minute abscesses are more frequent than in tubercle, and no centres of calcification nor any tubercle bacilli were found in the sections submitted to the Ziehl-Neelsen method of staining.

The lymphatic glands presented only slight changes, as cell proliferation, and it is interesting to note that no organisms were detected either by the Gram or by the Ziehl-Neelsen methods, whereas in the tubercular glands the tubercle bacilli were clearly defined.

The conclusion that the disease is contagious is founded on the history of outbreaks recorded, its rapidity of progress, 'and large mortality. It will be necessary to attempt the cultivation of the specific organisms and to inoculate subjects in order to place the matter beyond dispute. This, I anticipate, the Board of Health will sanction, in order to complete the subject. [This has since been accomplished.]

As a result of the investigations it is satisfactory to be able to state definitely that "pants in swine" is known to be two distinct diseases, tuberculosis and contagious pneumonia.

I would suggest that this disease, "contagious pneumonia in swine" be added to those schedules under the Diseases in Animals and Meat Acts, otherwise difficulty may arise in dealing with tuberculous swine or pigs with "pants."

I have, &c.,

EDWD. STANLEY, F.R.C.V.S.

Government Veterinarian.

E. Sager, Esq., Secretary, Board of Health.

Appendix A.

Re Swine Diseases.

Sir, Rodd Island, 16 June, 1891.

We have the honor of submitting this preliminary report of our experiments to determine the nature of a disease in swine known as the pants.

So far as regards the *post-mortem* appearances of the pigs we apparently find always the same disease. By microscopical examination in a few cases we found bacilli which, by their staining reactions, are very similar to those of tuberculosis.

Besides this we nearly always find another small bacilus. By inoculation of animals and cultivation in artificial media, we have not had tuberculosis, but nearly always the same bacillus which is easy to cultivate.

A pig ill with the disease and a healthy one were at the same time inoculated with Koch's tuberculine 0·01 c.c. each. They did not show any increase of temperature or any symptom of illness whatever during the thirty hours following the inoculation, the quantity injected in each case being the same as will cause reaction in a man affected with tuberculosis.

We have, &c.,

A. LOIR.

EDWD. STANLEY, G.V.

To the Secretary, Board of Health.

Appendix B.

Swine Disease—Experiments at Rodd Island.

Sir, Department of Mines, 5 December, 1891.

I have the honor to report that yesterday we killed a pig (naturally) suffering with the disease.

He was from three to four months old, in good condition, had a frequent cough, and panting breathing; he has been under observation a month, the disease making very little progress; he fed well, and was growing.

Post-mortem.—Sub-maxillary lymphatic glands much swollen, and becoming caseous, the gland structure being infiltrated with pus. The lungs, especially the smaller lobes, were carnified and studded with nodules and abscesses. The body of the large lobes was thickly studded by grey, small, tubercular-like nodules, but under the serous membrane.

The intestines were healthy, but the mesenteric glands were all more or less diseased.

The liver had characteristic gray patches, five or six from ½ inch to 1 inch in diameter, the tissue beneath being hard and infiltrated with blood. Spleen and kidneys were healthy.

I send herewith specimens of the diseased parts, hoping the Board will have them examined by a pathological histologist.

I am not at all satisfied with our knowledge of this disease up to the present time. M. Loir thinks it is a specific swine disease, due to a special microbe, but the microbe is intractable and uncertain. Even inoculation experiments give varying results, so that they cannot be relied upon.

The disease is not very fatal, and many affected will live, feed, and grow fat. It is very slow in progress when the animals are cared for, but if exposed and ill-fed they die sooner.

As to its being contagious, there can be no doubt; the majority appear to escape infection, but this would depend on local circumstances.

We intend to inoculate some healthy swine with bovine tubercle, and then compare the two diseased conditions.

With morbid specimens, sub-maxy, and mesenter glands; portion of liver; portion of lungs.

I have, &c.,

EDWD. STANLEY.

The Secretary, Board of Health.

APPENDIX C.

Report on specimens of lung, liver, sub-maxillary, and mesenteric glands from a pig killed at Rodd Island, 4th December, 1891, suffering from the disease known as the "pants."

The specimens were all in spirit. They were treated in the ordinary manner, and cut an ether-freezing microtome.

1. *Sections of Lung* :—The changes were of a subacute nature, and consisted in areas of condensed lung tissue, varying in size from a millet seed, or even smaller, up to nodules almost as large as a small pea. The larger nodules were made up of a number of smaller ones, united together by catarrhal and a certain amount of interstitial pneumonia. Areas of commencing caseation, surrounded by a small amount of fibrous tissue, were scattered through the larger nodules; and in some of the smaller nodules the same change was seen.* There were a few giant cells, but these were, for the most part, ill-developed.

When the nodules were sub-pleural the pleura was occasionally thickened over them, not, however, so markedly as it usually is in such cases. The smaller nodules were frequently in relation to one of the smaller bronchioles; and one could see in transverse section the centre of the nodule occupied by the bronchiole filled with catarrhal products, and surrounded by an area of small round cells, outside which there was frequently commencing catarrhal pneumonia. Others of the miliary nodules were more directly in relation to the lymphatics of the lung, and these resembled somewhat closely the ordinary miliary tubercle in the human lung.

There was well-marked bronchitis, numbers of the bronchi being filled with pus cells and catarrhal products which, in the case of many of the larger ones, became detached during the processes of cutting and mounting.

Several of the pulmonary vessels were congested.

Sections were stained in Ziehl-Neelsen's stain, and according to the Ehrlich-Weigert method for tubercle bacilli. Typical tubercle bacilli were found, but very few in number and irregularly scattered. Many of the miliary nodules contained one or more bacilli. Some of the larger nodules were found to contain a few also; but very careful search was required in order to detect them.

Other stains were used for the purpose of demonstrating ordinary bacilli. With the exception of a few micro-cocci, no definite micro-organisms apart from the tubercle bacilli were discovered.

The specimen is therefore one of tubercular broncho-pneumonia.

2. *Sections of submaxillary gland.*—Extensive calcareous change, involving a considerable portion of the section of the gland. Very little normal gland structure remaining, its place being taken by fibro-cellular tissue, in which were numerous giant cells often arranged in groups in different parts of the section. Tubercle bacilli, varying very much in size, but quite typical, were present throughout the section. As a rule the bacilli were isolated. In slide IIb, forwarded herewith, however, within the circle of ink which I have marked very imperfectly at one angle of the section, careful examination will reveal a large colony of tubercle bacilli arranged around a small blood vessel, and passing into the neighbouring tissue. Some were in giant cells in other parts of the section.

3. *Sections of mesenteric gland.*—Changes very similar to those affecting the submaxillary gland, and not requiring any separate description. Tubercle bacilli present in considerable numbers.

4. *Sections of liver.*—On examining with a naked eye, the cut surface of a piece of liver which had been preserved in spirit, it was at once observed that one portion differed very considerably from the rest. It was fairly well defined and seemed darker in colour and more fibrous than the other part of the cut surface. Indeed, it resembled a portion of a cirrhosed human liver with several localised apparently lobular-hæmorrhagic spots superadded. The microscopic appearances were of a complex nature.

It will be convenient to describe the changes in the diseased area under the following divisions:—

1st. *Changes in the fibrous tissue.*—As is well known, the lobules of the liver in the case of the pig are completely surrounded by fibrous tissue, which is of course more abundant in the so-called portal canals where it supports the branches of the vena portæ, hepatic

* Calcification was observed in one nodule in one section.

artery, and bile ducts. The individual lobules are therefore more sharply defined than is the case in the human liver. In this specimen there was very considerable increase in the amount of the fibrous tissue : this increase being due to a fibro-cellular hyperplasia with numerous small bile ducts embedded in it. The increase was not uniform throughout the diseased area, but was more marked in some places than in others. It involved not merely the portal canals, but the interlobular fibrous tissue as well. The hyperplastic tissue invaded some of the lobules as well as surrounded them, thus causing a gradual involvement, and finally entire disappearance of the lobule, its place being taken by the fibro-cellular tissue. So far the condition corresponds to what is known as ordinary or coarse cirrhosis of the liver—localised. But careful examination of this new interstitial tissue reveals in places the presence of minute rounded nodules consisting of small round cells—tubercle follicles in an early stage. These follicles were comparatively few in number.

Throughout the rest of the section the fibrous tissue was either quite normal, or at most a little more cellular in places.

Changes in the blood vessels.—Many of the branches of the vena portæ were congested. The walls of some of the branches of the hepatic artery seemed hypertrophied. The central or intralobular veins were dilated in the affected area, and the capillaries opening into them were likewise markedly dilated, and many of them were filled with blood. The sublobular veins were also congested. But the most marked change was noted in connection with some of the central lobular venous branches and the capillaries opening into them. The appearances varied from a small central lobular congestion of these vessels, with or without a minute capillary hæmorrhage, up to a condition in which the greater part of a lobule was occupied by a hæmorrhage. As a rule the hæmorrhage started at the central part of the lobule, and was confined to the lobule in which it originated. Occasionally, however, one or two adjacent lobular hæmorrhages appeared to run together. The contents of the hæmorrhages differed in different cases, some consisting of coagulated fibrin with very few blood corpuscles ; others of coloured and colourless corpuscles in normal proportions without fibrin filaments ; and others of both fibrin and corpuscles in varying proportions. Some had become transformed into masses of small cells, with a delicate capsule of young fibrous tissue into small abscesses in fact. Around many of these hæmorrhages there was observed an attempt at the formation of a fibrous tissue capsule. The hæmorrhages varied in size and number, and were easily recognised by the naked eye.

Third changes in the liver cells and bile ducts.—In the affected lobules, the liver cells were compressed and atrophied from pressure by the dilated capillaries. Where hæmorrhages existed the liver cells were destroyed in the area occupied by the hæmorrhage. Some of the bile ducts showed evidence of slight catarrh.

It is possible that the hæmorrhagic changes above described may be the initial stages of an ordinary cavernous angeioma of the liver, but they do not exhibit the typical structure which we are wont to associate with angeiomata. Further specimens, in a more advanced stage, are required for examination before this can be definitely settled. At present, it is difficult to account for their presence in this specimen, except on the supposition that they are due to obstruction of some sort, in some of the branches of the hepatic veins.

Tubercle bacilli were found in some of the tubercle follicles previously described. To sum up, there can be no doubt of the tubercular nature of the change in the lung, the submaxillary and mesenteric glands in this case. As regards inoculation experiments, might I suggest that guinea-pigs be inoculated with large quantities of fresh material from a recent case, and doubtless they would develop tuberculosis.

Windsor, 12th January, 1892. JOHN GIBSON, M.D.

Appendix D.

Tubercle in Swine.

Sir, Sydney 2 April, 1892.

In connection with the experiment being carried on at Rodd Island, I have the honor to report that I purchased, on 22nd November, 1891, three healthy store pigs, then about two months old ; they were kept under observation, and grew rapidly, and with every indication of perfect health.

On 28th January I secured some bovine tubercle, crushed it into a pulp with distilled water, and then injected a large quantity of the fluid (about 50 mims.) into the abdomen of one pig, and subcutaneously the same quantity on the thigh of the other pig.

No. 3 pig was kept as a control.
The object of the experiment was to be able to compare the pathological lesions of experimentally induced tuberculosis with the swine disease called "pants."
From the date of inoculation until death, both the pigs appeared to continue in good health; small tubercles formed at the seat of inoculation in each case; they did not increase in size after the fourth week; the pigs grew, and put on flesh and fat quite as rapidly as the control pig (all three lived together).
There was no cough or increased breathing or any indication whatever of any sickness.
On 30th March, sixty-two days after inoculation, they were killed.
The carcases were well nourished, and quite fat.

Post-mortem.

Thorax, no effusion in the cavities, or adhesions; both lungs were studded with gray miliary tubercles, with here and there a yellow spot of degenerating tubercle; submaxiliary glands were caseous, much enlarged, and tuberculous; omentum, was normal and very fat; spleen, excepting one suppurating nodule, was normal; kidneys, quite normal; liver, tunic healthy, several small abscesses underneath, like suppurating tubercles; mesentary, normal; large intestine, gray miliary spots in the mucuous membrane; peritoneum, normal, no serosity in abdominal cavity; glands, femoral, gastric, submaxiliary, and mediastinal were invaded by caseous tubercles.
In both pigs the lesions were very similar.
I send sections of lung, liver, spleen, glands, and intestine in absolute alcohol for microscopic preparations if necessary.
There was no carnification of the lungs, or serosity in cavities; two conditions very frequently met with in the "pants."
The control pig was killed and examined at the same time, and would seem to have contracted the disease by cohabitation. Although only very slightly affected, there was enlargement and commencing caseation of the submaxiliary gland, one caseous nodule in the lungs, one in the liver, and one in the spleen; in every other part the organs were healthy.
I inoculated at the same time guinea-pigs Nos. 31 and 32; both became very tuberculous. Specimens of their organs were sent to you on 3rd March in bottle marked C.

I have, &c.,

EDWD. STANLEY, F.R.C.V.S.,
Government Veterinarian.

To the Secretary, Board of Health.

Appendix E.

Subject:—"*Post-mortem* examination on guinea-pig at Rodd Island."

V. Barracks, 16 March, 1892.

Sir,

I have the honor to inform you that I have this day visited Rodd Island, and made a *post-mortem* examination on a guinea-pig, which died on the 14th instant.
The organs were more or less in a state of decomposition, which prevented a satisfactory examination.
The lungs were studded with minute yellow nodules, similar to those seen in bovine tuberculosis, only smaller.
Slight subcutaneous effusion existed in the seat of inoculation, inside of thigh.
None of the other organs presented any of the lesions peculiar to tuberculosis.

Yours, &c.,

WILLIAM SCOTT, M.R.C.V.S.

To the Secretary, Board of Health.

Appendix F.

Report on specimens received from the Board of Health, 5th March, 1892.

1. *Specimen A.*—Lymphatic gland from a pig condemned at the Abattoirs for tubercle, 9th February, 1892.

Sections of the gland exhibited extensive calcareous degeneration, which caused considerable damage to the edge of the razor. Microscopically, the greater part of the gland tissue was transformed into nodules of tubercle, varying in size, some of which had coalesced to form larger nodules. The centre of most of the nodules was calcareous.

No giant cells were seen. Tubercle bacilli, in considerable numbers, were present near the margin of the nodules, and in the gland tissue generally. [*See* slides A1, hæmatoxyline stain, and A2, Ziehl-Neelsen stain.]

2. *Specimen B.*—Lymphatic gland from a pig condemned at the Abattoirs, 22nd February, 1892.

This specimen was also highly calcareous. The tubercle nodules resembled very closely those in specimen A, and do not require any separate description. Tubercle bacilli present in varying numbers, in the nodules, and in the lymphatic spaces throughout the gland. [*See* slides B1, hæmatoxyline stain, and B2 Ziehl-Neelsen stain.]

3. *Specimen C.*—Spleen, lymphatic glands, liver, and lung from a guinea-pig thirty days after inoculation with bovine tubercle pulp, 1st March, 1892.

(*a.*) *Spleen.*—Several nodules, scattered through the surface of the section, apparently in relation to the malpighian corpuscles of the spleen. Stained for tubercle bacilli. These nodules contained numbers of bacilli, arranged singly, and in rosette-shaped groups. Isolated tubercle bacilli were found scattered through the splenic pulp. [*See* slide C1, stained by Ziehl-Neelsen method.]

(*b.*) *Lymphatic Glands.*—Sections of these showed caseous centre, with caseous tubercular nodules outside. Tubercle bacilli in large numbers, and in all stages of development, were seen. [*See* slide C2, Ziehl-Neelsen stain.]

(*c.*) *Liver.*—A few minute nodules, composed chiefly of groups of small round cells, and occupying for the most part the portal spaces of the liver were observed. These were evidently early tubercles, because in one or two there were attempts at giant cell formation, and tubercle bacilli were present, although few in number, and chiefly occupying the interior of the so-called "wandering" cell. [*See* slide C3.]

(*d.*) *Lung.*—In the piece of lung examined there was almost no appearance of tubercle formation proper. There was very considerable small cell-thickening of the inter-alveolar septa, and marked congestion of some of the pulmonary vessels, along with small hæmorrhages. In one or two places there were collections of small round cells, in all probability early tubercle follicle formation. Some of the bronchioles contained catarrhal products. Very few tubercle bacilli were found. [*See* slide C4, hematoxyline stain, and C5, Ziehl-Neelsen stain.]

Windsor, 29th March, 1892. JOHN GIBSON.

Report on Specimens received from the Board of Health, 5th April, 1892.

The Specimens were labelled, "Tubercle in swine, two months after inoculation with bovine tubercle 31/3/92." There were portions of lung, liver, spleen, glands, and large intestine.

Lung.

To the naked eye there were numbers of nodules, of firm consistence, scattered over the pleural surface of the lung, and, on section, the cut surface also contained nodules. These nodules varied considerably in size, some being about the size of ordinary miliary tubercles, others being larger. There was marked congestion of parts of the lung tissue. Under the microscope the larger nodules were seen to be formed by the union of two or more smaller ones, which latter were in turn made up of two or more so-called "tubercle follicles." Outside the larger nodules there was a variable amount of collapsed lung tissue, the seat of catarrhal pneumonia. Some of the nodules were calcareous in the centre. No typical "giant cells" were observed. Certain of the nodules were found along the line of the lymphatics, both pleural and peri-bronchial, &c. Very few bronchioles contained any catarrhal products, and the absence of marked bronchial catarrh constitutes the most important distinction between these sections and those from "pants," reported on 12th January last. This distinction, however, is doubtless due to the difference in the paths by which the tubercle bacilli gained access to the lung tissue. [*See* Report on "pants," 12th January.]

After staining with Ziehl-Neelsen's solution, tubercle bacilli were found, but not in large numbers, careful search being required to detect them.

See slide 1, stained by piero-carmine, in which near the apex a transvere section of one bronchiole may be seen filled with catarrhal products; and also slide 2, Ziehl-Neelsen stain, with tubercle bacilli.

Liver.

Slide 3 is intended to be used as a naked-eye specimen. It is mounted, unstained, in Canada balvam; and it will be noted that there are sections of two nodules at one angle of the preparation, these nodules being about the size of small peas. One is empty, the contents having dropped out; the other contains a casceous-looking material, which has been partly cleared up by the alcohol and oil of cloves used in mounting. The nodules are bounded by a delicate fibrous wall. Marked congestion of the branches of the vena portæ may easily be seen.

Microscopically.—Apart from the presence of the above-mentioned nodules, and the congestion of branches of the portal vein, very little of pathological importance was observed. The liver cells in proximity to the nodules were compressed and atrophied. Throughout the rest of the section they were granular and somewhat fatty. Some of the central hepatic venules were filled with blood. There was no increase in the interlobular connective tissue, nor any tubercle formation in the portal spaces in other parts of the section. In thin sections the greater part of the caseous contents of the above-mentioned nodules fell out during the processes of cutting and mounting. Here and there, however, small portions remain adherent to the wall. The wall itself consisted of fibrous tissue, and in some of the preparations sections of bile ducts and hepatic vessels were found in it, showing that the nodules had originated in the portal spaces. A few tubercle bacilli were observed in the caseous parts. It seemed as if the tubercle bacilli had been carried along the portal vein, and had set up a tubercular change in the walls of two of its branches, resulting in the formation of two tubercular abscesses. [*See* slides 4 and 5, the latter stained with Ziehl-Neelsen's solution for tubercle bacilli.]

Spleen.

In the spleen there was one caseous nodule, similar in size and appearance to those in the liver. One or two small tubercle follicles were scattered through the section. The malpighian corpuscles were prominent, and in several of them granules of golden-yellow pigment were present. Very few tubercle bacilli could be seen. [*See* slide 6, from near the margin of the large caseous nodule, stained with Ziehl-Neelsen's solution.]

Lymphatic Glands.

There were two sets of glands, but one description will serve for both, as the changes were almost exactly the same in each. The glands were highly tubercular. The central part of several of the tubercular nodules was calcareous. One or two attempts at "giant cell" formation were noted. Tubercle bacilli were found chiefly in proximity to the calcareous portions. In some parts they were fairly numerous; in others almost none were to be seen. [*See* slides 7, Ziehl-Neelsen stain, and 8, piero-carmine stain.]

Large Intestine.

A few small follicular ulcers were observed. There were increased numbers of small round cells between lielerkülıne's crypts, and the ordinary lymphoid nodules present in the submucous coat appeared more cellular than normal. I stained for tubercle bacilli, but failed to discover any. Slide 9, stained with hæmatoxyline, shows the follicular small, cell proliferation, and two lymphoid nodules.

Windsor, 19th April, 1892. JOHN GIBSON, M.D.

Board of Health Office, 127, Macquarie-street,
Sydney, 15 June, 1892.

Sir,

I have the honor of submitting this summary of the experiments carried on in order to ascertain the nature of the disease known as pants or heaves in swine.

Several diseased pigs were procured from the coast district; at various times, six of these were killed, and *post-mortem* examination were made by M. Loir and myself; in each case he made cover-glass preparations from the diseased parts, and carefully examined them for the bacillus of tubercle; in only two cases he considered he was successful, these were on May 25th, the other on December 4th. Diseased portions from the last pig were sent to Dr. Gibson, and he reported finding tubercle bacilli in prepared sections. [*See* his report, 253, 1892.]

To assist the investigation a total number of nine guinea pigs and sixteen rabbits were inoculated with pulp juice, obtained by crushing pieces of the diseased glands or lungs in sterilized broth or distilled water, with the result that not one single animal developed tubercles, all of them died very early, *i.e.*, within a very few days, not early enough for septicæmia, but too early for tubercles to develop.

M. Loir attributed the deaths to a special microbe, as the prevailing *post-mortem* appearances were serosities in large quantities in the serous cavaties. M. Loir left the Colonies to visit Europe about Christmas. Not feeling satisfied with the results so far obtained, I determined to inoculate two healthy pigs and two healthy guinea pigs with bovine tubercular virus, so as to study and compare the microscopical appearances.

I procured bovine material "perlschut" from the abattoirs and inoculate them. They all developed general tuberculosis (see report 1,675/92), with which specimens of diseased parts were furnished for Dr. Gibson's examination. His report of April 5 confirmed the nature of the disease. Tubercles were distinctly developed in several organs, and in other points bore no resemblance to the diseased pants.

Subsequently a pig was condemned at the abattoirs with the maxiliary glands in a tuberculous condition. Pieces were pulped with distilled water, with which I inoculated two guinea pigs and three rabbits. The rabbits all died the next day; one guinea pig died eight days latter. Mr. Scott, V.S., made a *post-mortem* examination, and reported tubercular deposits in various organs. The other guinea pig lived on, slowly developing tuberculosis, and was killed seventy days after inoculation; *post-mortem* revealed general tuberculosis. I send herewith pieces of the lung and gland for Dr. Gibson's examination as these are the first and only cases of producing tuberculosis by inoculation with swine virus.

I am of opinion that the swine have two distinct diseases—one tuberculosis, the other being a specific form of catarrhal pneumonia, often associated with pleurisy. I am confirmed in this opinion by the results of the inoculations, and by having quite recently discovered very minute bacteria in immense numbers in the lung tissue of a pig I had killed at Riverstone suffering from pants.

This microbe may by cultivation, &c., prove to be Fraenkel's pneumo-coccus, or it may be the specific microbe of this disease.

I have no doubt tuberculosis exists in swine, but up to the present proof is very scanty but not less important.

The subject is of great interest, and I sincerely hope that arrangements may be made to continue the investigation.

I have, &c.,

EDWD. STANLEY, F.R.C.V.S.,

Government Veterinarian.

E. Sager, Esq., Secretary, Board of Health.

Board of Health Offices, 127, Macquarie-street,

Sir, Sydney, 5 February, 1893.

I have the honor to report that Mr. Pound has completed the examination and preparation of microscopic specimens, from morbid specimens taken by me from sixteen different pigs.

Mr. Pound has been most persevering and successful, finding the bacteria difficult to stain. He has prepared over a hundred specimens, giving a complete histological insight into the diseases; and in five cases of contagious pneumonia—three from Enfield, two from Jamberoo—he has again demonstrated, what I think is the specific bacteria of that disease, in three out of five cases; the first time we found it in Riverstone pigs.

In eleven cases he has demonstrated tubercle histologically, and in seven the bacillus of tubercle is found.

In no case was he able to find both the organisms in the same subject, proving that we have two distinct diseases affecting the lungs and glands of swine—tuberculosis and contagious pneumonia.

It would be interesting to try isolation and cultivation of the contagious pneumonia bacterium (as the experiments carried on by M. Loir failed to convey the disease by inoculation), in order to demonstrate the contagion.

I have, &c.,

EDWD. STANLEY, G.V.

E. Sager, Esq., Secretary, Board of Health.

CONTAGIOUS PNEUMONIA IN SWINE—Concluding experiments.

Board of Health Offices, 127, Macquarie-street,
Sydney, 11 July, 1893.

Sir,

In connection with my report on this disease in swine, dated 18th February last, wherein it was stated that the contagious pneumonia was probably due to a specific micro-organism, I have now the honor to report, that the organism has been isolated from the lungs of diseased pigs, and successfully cultivated by Mr. Pound, in the Board's laboratory, and carried through several generations.

The disease has been induced experimentally by inoculating healthy guinea-pigs, and also common black-pigs of the Berkshire breed. The pathogenic results being identical with the original disease, which has already been described in detail in my former report. Only a few animals have been experimented on, but with such satisfactory results that the *materies morbi* of the disease is clearly demonstrated.

In order to explain briefly what has been done, I have appended two tables of experiments, to which I beg to refer you. We found that guinea-pigs possess a considerable immunity to the invasion of this disease. Of the seventeen experimented on, five were immune, eight were successfully inoculated, and four died under the operation. Whereas the eight Berkshire pigs inoculated, every one took the disease, no matter at what point of the body it was introduced, or what the state of the virus, *i.e.*, whether natural or cultivated artificially. The fever in them was very decided and fluctuating, the temperature ranged as high as 106° and 107° (the normal being 102·5°). The respirations increased ranging from thirty-five to forty-five, the normal being ten or twelve per minute. In every case the pathological changes were located in the thorax, and they were typical of contagious pneumonia. In these experiments Kochs' postulates as to the microbic nature of the disease have been strictly and completely carried out. The pigs lost flesh and ceased to grow, although feeding well all the time, and no doubt some would have regained convalescence, although the pathological changes in the diseased parts of the lung tissues would prohibit complete recovery. The slow progress of the disease was, no doubt, favoured by the liberal treatment and repose enjoyed by the animals while under observation. The fatality observed in epidemics is, no doubt, increased by unfavourable circumstances, such as bad food, bad shelter, and the general ill-usage to which these animals are commonly subjected. The experiments are by no means exhaustive. The question as to contagion from subject to subject by feeding, or by cohabitation, or the susceptibility or immunity of other animals to the contagion, have yet to be determined. And a disease similar to this is said by German authorities to be communicable to birds, pigeons, and fowls. In this Colony there are epidemic outbreaks of disease in poultry where pigs are kept, the nature of which is unknown. These are interesting points that must remain unsolved for the present. This disease, contagious pneumonia in swine, somewhat resembles the Schweineseuche, or German Swine Plague. It is quite possible that it is a modification of that disease imported into the Colony several years ago.

Now that the restrictions which wisely prohibited the importation of swine from foreign countries have been removed, and the ports of the colonies are thrown open, it is most likely that other contagious swine diseases will be introduced, such as have in the past and are still causing immense losses both in Europe and America. It seems, therefore, advisable to have legislative power to deal with outbreaks of disease that already exist or that may arise.

This disease, swine pneumonia, has since been scheduled as a disease under the Contagious Diseases in Animals Act.

Mr. Pound's report on his work with the micro-organism of this disease, which he has been good enough to illustrate with sketches of the microbes, and also of the diseased parts, I append hereto, and I have to thank him for the great interest he has taken in bringing this investigation to a satisfactory conclusion.

I have, &c.,

EDWD. STANLEY, F.R.C.V.S.,
Government Veterinarian.

E. Sager, Esq., Secretary, Board of Health.

No. 1.—TABLE to illustrate a series of experiments with disease of Swine, Contagious Pneumonia.

Guinea-pigs.	Date inoculated.	Where inoculated.	Source of virus.	Remarks.	Results.
	1893.				
A. Male ...	22 Feb. ...	Thorax	Lung exudate ...	....	Recovered.
B. " ...	22 " ..	"	Riverstone Pig ...	....	"
C. Female	22 " ...	Lung	" " ...	....	"
D. " ...	22 " ..	Abdomen ...	" " ..	....	"
E. Male ...	10 Mar. ...	" ...	Lung exudate; Camden pig.	Died in 7 days ...	Small clarnified patches in lungs; adhesive lymph serosity in abdomen.
F. Female	10 " ...	Thorax	" " ...	Died in 2 days ...	From operation; lungs inflamed.
G. Male ...	10 " ...	"	" " ...	Died same night ...	From operation; accidental lesions.
H. " ...	10 " ...	Lung	" " ...	Died in 5 days ...	Acute double pleurisy; lymph and servus effusion; carnified patches on lungs.
I. Female ..	21 April...	Thorax	Broth culture; 6th generation from the Camden pig.	Died same night ...	Accidental lesions.
J. Male ...	21 " ...	Left thigh ...	" " ...	Died in 9 days ...	Lungs partially carnified, and adhesive lymph filled the thorax.
K. " ...	21 " ...	Right thigh ...	" " ..	Killed on 10th day.	Recovering; no lesions in thorax.
L. " ...	21 " ...	Thorax	" " ...	Died same night ...	Accidental lesions.
M. " ...	30 " ...	Left thigh ...	Lung exudate from J.	....	Much swelling; lost flesh, then recovered.
M. " ...	14 May ...	Right thigh ...	Broth culture; 2nd generation from J.	Killed on 17th day	Both lungs much carnified; no effusion.
N. " ...	30 April...	Two inoculations the same as M and identical results.			
N. " ...	14 May ...				
O. Female.	14 " ...	Behind shoulder.	Broth culture; 2nd generation from J.	Killed on 17th day.	Patches of carnification in both lungs; no effusion.
P. Male ...	14 " ...	Thorax	" " ...	Died in 5 days ...	Both lungs carnified; adhesive lymph filled thorax and pericardium.
Q. Female	14 " ...	Left thigh ...	" " ...	Killed on 17th day.	Both lungs carnified patches, especially the right; no effusion.

No. 2.—Table to illustrate a series of experiments with the disease of Swine-Contagious Pneumonia.

Berkshire pigs.	Date inoculated.	Where inoculated.	Source of Virus.	Remarks.	Results.
	1893.				
1. Female.	6 May ...	Behind shoulder	Broth culture, 2nd generation from guinea pig J.	Killed on 24th day	Lungs carnified, anterior lobes, and mapped with congested lobules, with distinct septa; no effusion in thorax; bronchal glands swollen and gelatinous.
2. Male ...	19 „ ...	„	Broth lymph exudate from thorax guinea pig P.	Killed on 34th day	Lungs, anterior lobes, and part of larger lobes carnified; septa very distinct; solid parts degenerating; studded with miliary abscesses; no pleurisy; bronchal, thoracic and maxillary glands much swollen; caseous and calcareous spots.
		Control.			
3. Female	6 „ ...	Constantly cohabited with No. 1 and No. 2.		Killed on 49th day	Internal organs perfectly healthy, and pig in good condition.
4. Male ...	31 „ ...	Left thigh ...	Lung lymph from pig No. 1.	Killed on 18th day	Parts of both lungs, left extensively carnified; sub-maxillary glands much swollen and caseous infiltration.
5. Male ...	31 „ ...	Behind right shoulder.	„ „	„	Anterior lobes both lungs carnified, and both sub-maxillary glands much swollen and caseous infiltration.
6. Female.	31 „ ...	Thorax	„ „	„	Lungs several small areas of carnification; extensive pleurisy with yellow adhesive lymph, filling the thorax, also adhesive lymph over stomach, liver, and splen; bronchal and thoracic glands degenerating.
7. Male ...	31 „ ...	„ ...	„ „	„	Both lungs adherent and extensively carnified; lymphatic glands swollen and degenerating.
8. Male ...	31 „ ...	Thigh	Broth culture 10th generation.	„	Only very small carnified patches.
9. Female.	31 „ ...	Behind shoulder	„ „	„	Both anterior lobes carnified and spreading freely into right lung, and slightly into left; no effusion; glands swollen.

Board of Health Offices, 127, Macquarie-street,
Sir, Sydney, 12 July, 1893.

I have the honor to submit to you a report on further observations into the Etiology of Contagious Pneumonia in Swine.

A pig on arrival from the Camden district at one of the metropolitan sale-yards was found to be suffering from the disease, and was subsequently killed for experimental purposes by the Government Veterinarian.

In the morbid tissues of this animal I was fortunate enough to not only identify the specific micro-organisms microscopically, but succeeded in isolating and cultivating them artificially on various nutrient media.

The cultivations were carried on through several successive generations, from gelatine to agar agar, then to bouillon and back again to agar agar, and so on through a considerable number of tubes, after which followed a series of experiments on guinea pigs and swine, carried out with Mr. Stanley, in order to determine their virulence and pathogenic nature.

While these experiments were in progress I took the opportunity of studying some of the morphological and biological characters of the organism.

The disease was transmissible to guinea pigs which were inoculated with the virus obtained from the lung of an infected pig, and the specific bacteria found on examination and again cultivated.

A cultivation of the tenth generation from a guinea pig was used for inoculating healthy swine, all of which contracted the disease.

From every experimental animal that was killed or died after successful in oculation I made inoculations on nutrient gelatine, agar agar, and broth ; but although the cultures were occasionally contaminated, I could always obtain a pure cultivation of the specific organism by the employment of the plate culture method.

No matter where an animal had been inoculated, either the thigh, shoulder, or in the thorax, the disease always became more or less confined to the lungs. The anterior or ventral lobes are first attacked, then the inflammatory process gradually proceeds down the principal lobes.

The naked eye appearances of the lungs in an acute case are shown in and appended drawing. The lobules in the ventral lobe have a decided livery aspect, while the principal lobe has a beautiful mapping out appearance, brought about by increased thickening of the interlobular connective tissue, whereby the lobules, which vary considerably in shade and colour, become very distinct. Occasionally a lobule very much consolidated and dark in colour is seen surrounded by apparently normal looking tissue.

In very advanced cases the bronchial, submaxillary, inguinal glands were much enlarged, and in one or two cases were commencing to suppurate.

On cutting across the lungs in the acute stage a considerable quantity of sanguinous frothy matter exuded from the bronchi, which in a more cyronic form of the disease was replaced by a gelatinous muco-purulent matter.

In microscopic sections of the lung in the early stage we fined the alveoli and bronchioles greatly distended with inflammatory products, there is also frequent extravasation of blood, giving rise to hæmorrhagic infarcts, due to over-distention of the alveoli surrounding the blood vessels, with masses of leucocytes and fibrinous matter.

The interlobular connective tissue is greatly thickened and filled with clear lymphoid matter, which gives the mapping out appearance so frequently seen on post-mortem examination.

As the disease advances the bronchi become engorged with cells, which, with the epithelium lining the walls, are seen to be in various stages of disintegration. Frequently portions of the walls of the bronchi are so broken up that the contents are in direct communication to the surrounding tissues.

By making a series of microscopic sections of cover-glass preparations from diseased tissues in the acute stage, and staining after Leoffler's method, or by any of the aniline dyes usually employed, it is frequently only with prolonged examination with an immersion lense that one comes across even a few bacteria that can be regarded as presumably the specific forms, but, on introducing a scraping or a little of the exudation from the aveolar tissue into a tube of agar agar or bouillon, their presence is invariably detected after a few hours' incubation at 35° centigrade.

The reason they are so difficult to demonstrate in microscopic sections, apart from their sparse distribution throughout the tissues, is because they are like such organisms as glanders, typhoid and chicken cholera bacteria. Only a single stain can be used, for both tissue and organisms, consequently they are almost obscured by their taking the stain only very faintly, while the tissue cells, especially the nuclei, stain intensely.

In chronic forms of the disease other organisms are frequently met with, viz., the Staphplococcus pyogenes aureus, Streptococcus pyogenes, and other bacteria more or less of a pyogenic nature.

It is quite evident that these septic organinisms play an important secondary part in this disease by considerably hastening its progress.

Their presence in the air, soil, and water has been frequently confirmed by numerous observers, therefore, whenever they gain access to any suitable media they readily commence to grow.

In the case of contagious pneumonia in swine certain tissues have been seriously impaired by the previous introduction of a specific bacterium. The general depression of vitality of such morbid tissues render a nidus admirably suited to the requirements of these pyogenic organisms. Having once gained admittance and obtained a foothold in such a pabulum provided with food moisture and a perfect incubating temperature, in fact, everything favourable for the reproduction of their species, they immediately produce their deleterious effects.

By their rapid multiplication and growth, accompanied by the formation of toxic products, they produce morbid changes in the adjacent tissues characterised by caseation and necrosis. These necrosed areas gradually increase in size until they coalesce and form large abscesses, which may break down and suppurate, ultimately giving rise to pleuritis and pericarditis, which usually terminates in the death of the animal.

Sections from these necrosed parts of the lung, stained with alum carmine and Gram's method, present a very beautiful and instructive specimen both for high and low power objectives. The line of demarcation between the hepatized and necrosed parts are distinctly brought out by a barrier of leucocytes, the nuclei of which are stained a much deeper red than other parts of the section, while the blue colour of the Gram's stain selects the pyogenic organisms which are seen in extraordinary large numbers scattered throughous the dead tissue. In cover-glass preparations stained by the same method, and examined under an immersion lense, the micrococci are seen in chains and groups.

Cultivations made from these necrosed areas show only very few of the specific organisms, more frequently none at all, while the pyogenic organisms are found in enormous numbers.

The reason for the absence of pneumo-bacteria can only be accounted for by their being strictly aërobic, viz., their inability to thrive without oxygen, of which in such morbid tissues there can only be a very small amount. On the other hand the staphylococcus aureus and streptococcus pygenes are really facultative aërobic organisms, and, in consequence, these dead tissues afford a nidus as well adapted to their requirements as the surface of an agar agar plate in the laboratory where they have free access to a plentiful supply of oxygen.

Morphology and Biology.

There is a striking resemblance between the pneumo-bacteria in swine disease and the microbe of chicken cholera, both in the appearance on cultivating media and in stained preparations examined under the microscope, although by constant and careful observations I have been able to detect several minute differences.

They stain readily with any of the aniline colours usually employed, but for minute details Kühne's carbolised methylene blue is to be preferred. They do not retain their colour when treated by Gram's method.

Both in animal tissnes and on various culture media they are found to vary very much in size. In cover-glass preparations, stained with Kühne's blue, they appear mostly as very short rods with parallel sides and distinctly rounded ends. As a rule, the extremities or poles of each individual rod are stained more deeply than the central portion, which varies in size in different organisms. These clear spaces in some preparations examined only under a moderate magnifying power might be easily mistaken for spores.

In size they are more often twice as long as broad, but occasionally several are seen where the length exceeds ten times the breadth. These filamentous forms stain very uneven, in some the colour is intense at one end, and gradually disappears at the other end; others again may be uniformly stained, but only slightly, or may have a granular appearance; the outlines of these larger organisms are also very irregular, which gives the idea of their being involution forms. Being aërobic they naturally require a plentiful supply of oxygen; should, however, this be in any way limited, their growth is correspondingly retarded.

Moisture is also necessary to keep up the vitality, for I find that cultures kept in the laboratory for several weeks, and allowed to become dry, could not be resuscitated on making subcultures in fresh nutrient media.

I have kept several hanging drop cultivations under constant observation for some time at various temperatures, but failed to recognise anything like endogenous spore formation.

Reproduction takes place by fission only; division takes place in a direction at right angles to the longitudinal axis. Under favourable conditions a single rod will grow to twice its normal length, then a constriction in the middle of this lengthened rod, and finally complete division whereby the two daughter cells become detached; sometimes, however, this process of cell division is incomplete, hence one finds several rods held together in the form of short chains.

They are non-motile, nothing beyond the Brownian movement can be observed when examined in the living condition suspended in drop of bouillon.

Cultivations in various stages of growth are quite inodorous, nor is there any perceptible formation of gas.

The growth on 10 per cent. nutrient gelatine at 18°-20° centrigrade is very slow, and forms a delicate white or greyish layer, but does not cause liquifaction. Upon gelatine plates the colonies are first seen after several days, as small white points. When examined under the microscope each colony has a light brown colour; the colony gradually increases until it attains the size of a hemp seed, having a decided shining convex surface and circumscribed margin. At this stage further development ceases, due, no doubt, to the nutrient media losing its moisture by evaporation.

Upon the surface of 2 per cent. nutrient agar agar after twenty-four hours incubation at 35s C. the growth is very marked, forming an elevated mass, which, however, does not spread far beyond the line of inoculation. In bouillon a slight cloudiness is formed, which does not become very dense.

No appreciable growth takes place on potatoes. A peculiar feature is exhibited in cultures of several days' growth on oblique gelatine when examined under the microscope with a 24 m m objective and 12 com. oc. (see plate 9) running out at right angles to the needle track are extremely minute delicate striæ, which closely resemble the tracheal system in insects. This peculiar appearance has not been noted in cultures of the chicken cholera bacterium or allied varieties.

An interesting point to be noted is the striking similarity between the specific micro-organism in contagious pneumonia of swine and the bacteria which are associated with such diseases as swine fever in England, swine plague in America, wildseuche and schweineseuche in Germany, also rabbit septicæmia and chicken cholera.

Although the micro-organisms in these diseases have apparently the same morphological characters, considerable difference of opinion exists among the various observers who have directed special attention in studying their life history. Some regard them as varities of a certain genus, while others are inclined to believe them as practically identical.

The slight individual differences observed under the microscope, and the variations noticed on cultivating media, may be attributed to the previous conditions of environment in different species of animals, such as susceptibility, peculiarity of the soil, and variations in temperature.

In concluding this report, it must be admitted that our knowledge is still very incomplete, but nevertheless, enough has been gained to enable us to judge what are the essential factors which come into play in the production of this disease. That the specific pneumo-bacteria are absolutely necessary for the production of acute contagious pneumonia in swine there can no longer be any doubt, but at the same time, as previously mentioned, considerable importance is attached to the presence and action of the pyogenic bacteria as secondary factors in the more chronic forms of the disease.

I have, &c.,

C. J. POUND.

Edmund Sager, Esq., Secretary, Board of Health.

Practical Vegetable Growing.

Directions for the Month of July.

July is one of the coldest months of the year in most parts of New South Wales, and plant-growth is slow. Opportunity should be taken to dig up any ground that may not be in use, so that it be exposed as much as possible to the mellowing influence of frosts. This is a good time to prepare land for the spring vegetables, so that it may be ready for early sowing and planting. To attain success in vegetable growing it is necessary that the soil should be thoroughly well dug and properly drained. The deeper the soil is dug the better provided the surface soil is kept on the surface as much as possible. If the soil of the garden be not naturally rich it must be well manured with rotten farmyard manure, that is, the droppings of animals mixed with straw or vegetable matter.

The present article ends a twelvemonth series of directions for vegetable growing, but in the future these articles will be revised and extended as much as possible. It is satisfactory to the writer to know that they have been the means of directing the attention of many to the important subject of producing home vegetables. It is often pitiable to see, about farms and settler's homes, the absolute waste of good land where, with but little labour, excellent vegetables can be grown with but little more work than sowing the seeds. But no attempt is made to produce even a simple herb, and if the Chinaman does not come round, the family has to do without a vegetable. Such a state of things is disgraceful in a country like this where every child must attend school. It is worthy of note that some of the Public school teachers, to their great credit, teach many of the school children after the days work is over how to grow various kinds of plants. If this were a general practice an immense amount of good would be done to the Colony, and it is not too much to hope that the Department of Public Instruction may see its way in the near future to require all teachers to pass an elementary training in horticulture, so as to become qualified to teach the rudiments, at least, of gardening. It will be a great blessing for this country, when the elements of agriculture, as well as of horticulture, are taught in the Public schools. For all country schools this should form one of the most important portions of the curriculum. And, doubtless, the time cannot be far distant when it will be carried into effect.

Asparagus.—Preparation should be made for planting this useful and wholesome vegetable. There is no need to plant until next month, or even later, so long as the buds or shoots have not started into growth. But the ground should be made ready without delay, and then the planting can be done at leisure.

Dig the ground at least 18 inches deep, or better still trench it 2 feet deep, without turning the surface soil to the bottom of the trench. It may be pointed out that there is a certain danger in trenching a small portion of

a garden by itself unless provision be made to drain it thoroughly otherwise the part trenched will be apt to retain too much water and this will injure the plants unless the ground is naturally well drained. The fact is that the whole of the garden should be trenched before anything is sown or planted. If roots and stumps have been cleared away to a sufficient depth the work can be done sufficiently effectively by a subsoil plough, bear in mind, not a trench plough. But if the area set apart for a vegetable garden be small this work would have to be done before the ground is fenced in. Nothing, however, is so effective as spade work.

Artichoke Jerusalem.—Make preparations also for the planting of this vegetable. It will grow without much preparation, but the produce will be but small. The ground should be well dug, well drained, and well manured with rotten farmyard dung.

Beans French, or Kidney.—It may seem almost absurd to those who live in the cold districts to recommend the sowing of French beans, but there are some parts of the Colony where they will succeed even in midwinter, therefore, a few rows may be sown with good chances of success.

Beans Broad.—A few rows may be sown, if any more plants be required.

Broccoli.—Sow seed to as great an extent as you may need.

Cabbage.—A little seed may be sown in a seed bed or box. Sow in little drills 2 inches or so apart, and do not use too much seed. Try several kinds of seed to ascertain which variety succeeds best in your district. If you have any good strong seedlings, transplant them to some well manured ground that has been prepared for them.

Cardoon.—Is a vegetable worth testing for it is much liked by some persons. It belongs to the Globe Artichoke family and somewhat resembles that vegetable, but the tender leaves of the heart of the plants are eaten and not the flower buds as in the case of the artichoke. The seed is sown in spring and the seedlings are afterwards transplanted to well manured beds, but this transplanting must be done very carefully or else the seedlings will die. It is the custom to sow seed in well manured trenches, like celery trenches, and when it comes up, to thin the plants out to about 18 inches or 2 feet apart. The plants need good supplies of water and rich soil. When they have attained a good size they will need earthing up like celery in order to blanch their hearts. Leaves or straw should be tied round each plant before earthing up so as to prevent any soil dropping in amongst the leaves.

Carrot.—Sow a little seed in drills about 1 foot to 18 inches apart. Thin out when the plants are large enough and keep quite free from weeds.

Cauliflower.—Sow a little seed to keep up a supply and plant out any strong young seedlings you may have on hand.

Cucumber.—In the warm coast climates sow a little seed in a sheltered position. It would be advisable to protect the bed at night with some bagging or other material, for fear of chance frosts or severe cold.

Capsicums or Chillies.—May be sown and protected as recommended for cucumbers.

Egg plants.—Seed may also be sown in the warm districts.

Leek.—Sow a little seed to keep up a supply. Plant out good strong young leeks to well manured trenches and keep them well watered if the weather and soil are dry.

Lettuce.—Sow a little seed and plant out strong seedlings to well manured ground.

Onion.—Sow a good quantity of seed on well manured and well drained narrow beds where the seedlings can be weeded easily without treading amongst the plants. Sow in drills and cover the seed very lightly with fine soil.

Parsnip.—Sow a little seed.

Peas.—These may be sown largely in rows from 3 to 4 feet apart according to the height of the variety. For the higher it is likely to grow, the wider apart the rows should be.

Savoy.—Sow a little seed in a seed bed. If any strong seedlings are available they may be planted out. The soil should be well manured before planting.

Spinach.—Sow a little seed in drills 2 feet apart and thin out the plants when they come up to about 1 foot from plant to plant.

Swede turnip.—Sow a little seed in drills

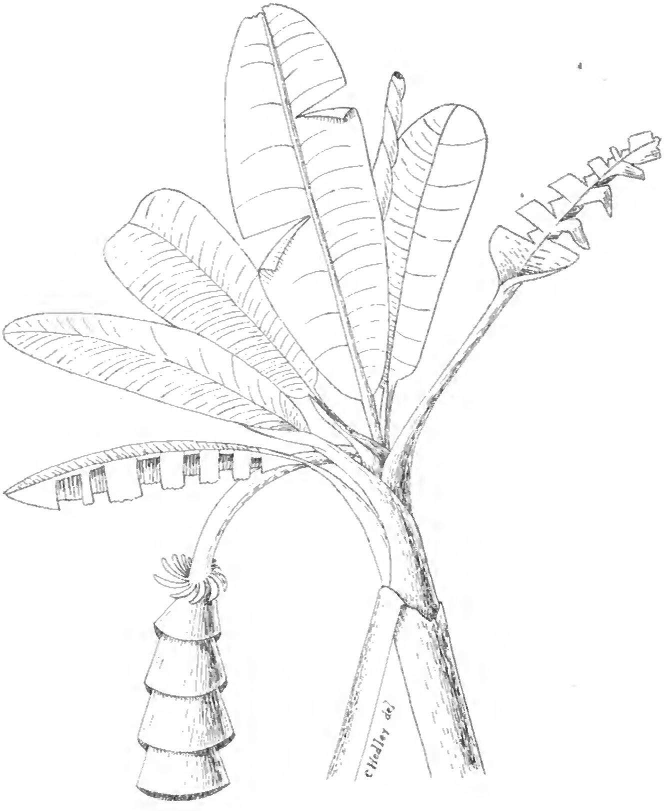
Tomato.—Seed may be sown in the warm climates, but protect at night.

Turnip.—Sow a little seed in drills.

Orchard Notes for July.

In a well cared for orchard July should be a busy month especially in the Cumberland orchards, as there is the pruning of the summer fruits to attend to. The planting out of new trees where old or dead trees have been taken out and the setting out of new orchards in addition to the gathering, curing, and storing of the balance of the main crop of lemons, and the gathering, packing, and selling of a large part of the orange crop. As the orange-trees should always be well lightened during the month—as early in August the fruit often commences falling—every endeavour should be made to place the orange crop on the market in a satisfactory condition and to arrange for the relief of our local markets by a judicious exportation of our surplus fruit. This can only be accomplished by the fruit-growers combining and establishing centrally-located packing houses which will turn out a straight grade of goods that can be depended upon, and will export nothing that is not suitable for the foreign market. The present method of individual export without due regard to the grade, packing, and cases suitable for the foreign market is the greatest mistake possible, as besides usually ending in loss to the exporters it gives our fruit a bad reputation which can only be removed by the maintenance of a standard grade under distinctive brands.

The cultivation of the orchard during the month will be confined to ploughing, and if there is any slack time drains may be made where necessary, and all surface drains should be well attended to. In planting out young trees always obtain yearlings—trim the roots carefully, and do not plant too deep—always prune back hard at planting if you want a strong and well-grown tree, and do not head too high, cutting back to knee high is a good general rule to go by. Never place any manure in the hole with the tree when planting. Where apple-trees are badly affected with woolly aphis they should be well sprayed two or three times during the month with the resin and soda wash, using a Nixon nozzle and applying the spray with all the force possible—winter sprays to destroy scale insects, red spider, &c., on deciduous trees can be applied any time during the month.



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PROTECTED BANANAS.

General Notes.

How to save Bananas from Flying Foxes.

The following interesting note has been forwarded to us by C. Hedley, F.L.S.:—

A former neighbour of mine on a Queensland selection grew bananas of a quality and quantity that raised his society in the estimation of us all. His selection was the most popular place in the district, for a time. It was never any trouble to ride over with his mail, to lend him a novel or tell the latest yarn, for a while.

His garden was a bit of hill scrub land, red stony soil, formerly a jungle of palm and pine, and it grew bananas to perfection. A few years before he had brought carefully in his portmanteau from Brisbane the first Cavendish sucker seen in the district. It throve, and each fresh sucker that it threw off was planted out. The first bunch that ripened was divided with great ceremony, but soon bananas became so plentiful that everyone was welcome to eat all he could and stuff his pockets full when he left. This was when our friend became such a favourite.

But as bananas continued to increase, production outgrew consumption, and more and more were left to waste in the garden. Then the flying foxes attracted by the scent, tasted the new fruit, approved of it, and presently devoured all they could find. At last even green bananas were destroyed and the owner had to gather his bunches unripe and hang them indoors to mature.

So the education of the flying fox resulted in fewer and worse bananas, which again diminished my friend's popularity.

Years afterwards in the interior of New Guinea, I learnt a trick to save bananas from flying foxes. As this simple plan of the savages may well be copied by Australian selectors, I have sketched a banana plant muffled in Papuan fashion and add the description from my note book.

A banana leaf torn in half down the centre is wrapped round the lowest "hand" of the bunch left hanging on the bough, the leaf midrib being tied round the stalk of the bunch; another half leaf is wrapped round the "hand" next above, leaving enough margin to lap well over beneath, and so on till the bunch be covered hand above hand. The whole then looks something like a huge unstripped maize cob. This shelter the flying foxes are unable to penetrate, and the fruit ripens as well bandaged up as open.

Worms in Fowls.

It would appear from a letter recently received from Mr. G. M. McKeown, of the Government Experimental Farm at Wollongbar, that fowls in that district are suffering in considerable numbers from intestinal worms. Three birds so affected were forwarded to the Department by that gentleman, and

have been subjected to examination by Dr. Cobb, the Departmental Pathologist, who has made the following report which is reproduced in order that it may be more fully circulated, and advantage taken of the information it contains:—

REPORT.

The fowls were examined for internal parasites, as no other cause of disease was indicated.

(1.) The first one opened contained a single round worm of the sort known as *Heterakis inflexa* (Rud), located in the small intestine; and several scores of the round-worm known as *Heterakis papillosa* (Bloch), located in the two blind-sacks attached to the intestine. The single worm (*H. inflexa*) was about 2½ inches long. The smaller worms (*H. papillosa*) were reddish, and about half-an-inch long.

(2.) The second fowl contained only *H. papillosa;* some hundreds of them were present. Also, about a dozen tape-worms, probably belonging to the species *Taenia proglottina* (Dav.)

(3.) The third fowl contained no parasites.

It appears to me that the worms seen by Mr. McKeown, and mentioned in his letter, are *H. inflexa*, which is the only species of round-worm or Nematode, which has, thus far, been suspected of causing epizootics. I observed no signs of perforation such as Mr. McKeown describes, and should feel greatly obliged if he could forward me specimens that would show such perforations. Such a phenonemon, if verified by scientific examination, would be a distinct addition to our knowledge of the diseases of the fowl.

REMEDIES.

(A.) The administration of pills made as follows, has been followed with good results in cases of epizootics apparently caused by *H. inflexa.*

1. Take equal parts root of Male Shield-fern, Tansy, Savory.
2. Make a decoction of this, using 10 oz. to three pints of water.
3. Take the liquor of the above decoction and make it into pills with flour, and administer them, forcibly if necessary.

(B.) I would advise Mr. McKeown, however, that prevention is much cheaper than cure, and that my experience is much in favour of the use of such measures, as follows:—

1. Remove the fowls to new land which has not received drainage from that on which they acquired the disease.
2. If that cannot be done, make a whitewash, and sprinkle it copiously on the ground used by the fowls; also, whitewash the houses and roosts.
3. The use of sulphate of iron with the lime or better still, following it, will be of advantage. Use as strong a solution of sulphate of iron as can be made in water, and sprinkle it about.
4. The destruction of diseased fowls by fire is advisable.

Marketing the Choco.

An officer of the Department who raised a fine crop of chocos at Pennant Hills recently sent half a case (containing thirty-nine), to market along with a neighbour's fruit. The half-case realized 2s. 6d., and the grower received 2s. net. As the choco is very easy to grow, the roots shoot out and bear the second year, and, at present, the choco is practically unknown on the market, this sale must be taken as very satisfactory, and there appears no doubt that in the future it will prove very profitable as a side crop for the orchardist. If the soil is kept fairly loose the plant thrives in a heavy soil with a clay subsoil, although a light, well drained soil will probably produce better results.

Hawkesbury Agricultural College.

The Principal desires it to be notified that there will be a few vacancies for resident students next session, which commences on or about the 23rd July next, and that those desirous of competing at the coming preliminary examination should make early application to the Department of Agriculture for forms of application and prospectus.

Enquiry into the Value of Spotted Gum for Wood-paving.

The Minister for Mines and Agriculture has appointed a committee (consisting of Mr. T. S. Richards, City Surveyor; Mr. J. V. de Coque, Timber Inspector, Public Works Department; and Mr. J. H. Maiden, Consulting Botanist to the Department of Agriculture), to inquire into the merits of spotted gum for wood-paving. Any persons who have evidence to offer to the committee are requested to forward it to the Under Secretary as soon as convenient. Specimens of timber should be sent, when considered desirable, to elucidate evidence.

AGRICULTURAL SOCIETIES SHOWS, 1894.

Society.	Secretary.	Date.
Dapto A. and H. Society	A. B. Chippindale	Jan. 9, 10.
Clunes Agricultural Society	J. W. Brown ...	,, 17, 18.
Albion Park A. and H. Association	T. Armstrong ...	,, 17, 18.
Kiama A. and H. Association	J. Somerville ...	,, 25, 26.
Holt-Sutherland H. and I. Society	W. Douglas ...	,, 26.
Wollongong A. and H. Association	A. J. A. Beatson...	,, 31, and Feb.
Berry A. and H. Society	A. J. Colley ...	Feb. 6, 7, 8.
Gosford A. H. and I. Association...	H. S. Bevrendge...	,, 9, 10.
Luddenham A. and H. Association	K. Campbell ...	,, 13, 14.
Manning River (Taree) A. and H. Association ...	W. Plummer ...	,, 14, 15.
Lithgow A. and H. Society	M. Asher... ...	,, 15, 16.
Shoalhaven (Nowra) A. and H. Association ...	R. Leeming ...	,, 15, 16.
Marulan P. and H. Society	H. Morrice ...	,, 23.
Kangaroo Valley A. and H. Society	H. Joyce	,, 25, 26.
Candelo A. and H. Association	C. H. Brooks ...	,, 27, 28.
Tumut A. and P. Association	W. H. Bridle ...	,, 27, 28.
Tenterfield P., A., M., and H. Society	J. Harker... ...	,, 27, 28, and Mar. 1
Port Macquarie A. and H. Society	A. E. Poutney ...	,, 28 and Mar. 1.
Lismore A. and H. Society...	C. S. Connor ...	,, 28 and Mar. 1, 2.
Berrima District (Moss Vale) A., H., and I. Society	J. Yeo	Mar. 1, 2, 3.
Nepean District (Penrith) A., H., and I. Society	R. Benaud ...	,, 1, 2, 3.
Robertson Agricultural Society	R. J. Ferguson ...	,, 6, 7.
Uralla P. and A. Association	J. D. Lecce ...	,, 6, 7.
Bega A. and P. Association	A. J. Wilson ...	,, 7, 8.
Inverell P. and A. Association	J. M'Ilveen ...	,, 8, 9.
Picton Agricultural Society	G. Bradbury ...	,, 8, 9.
Cobargo A. and P. Society...	J. Graham ...	,, 13, 14.
Tumberumba P. and A. Society	W. Willans ...	,, 13, 14.
Glen Innes P., A., and M. Association	J. Denshire ...	,, 14, 15.
Goulburn Agricultural Society	J. J. Roberts ...	,, 15, 16.
Gulgong Agricultural Association...	C. E. Hilton ...	,, 16, 17.
Armidale (Combined Show), A. and P. Association	W. H. Allingham	,, 20, 21, 22.
Taralga A. and P. Association	J. J. Walsh ...	,, 21, 22.
Royal Agricultural Society (Sydney)	F. Webster ...	,, 21 to 27.
Braidwood P. and A. Association...	G. F. Taylor ...	,, 22, 23.
Castle Hill A. and H. Association	F. H. G. Rogers...	,, 26, 27.
Orange A. and P. Association	J. S. Thomas ...	,, 28, 29.
Walcha P. and A. Association	H. Chapman ...	April 4, 5.
Lower Clarence (Maclean) Agricultural Society...	J. S. Dunnet ...	,, 4, 5.
Camden A., H., and I. Society	W. R. Cowper ...	,, 4, 5.
Gundagai P. and A. Society	W. E. Kyle ...	,, 5, 6.
Blayney P. and A. Association	G. H. Woolly ...	,, 5, 6.
Gundaroo P., A., and H. Association	J. Affleck... ...	,, 6.
Namoi (Narrabri) P., A., and H. Association ...	J. Riddle... ...	,, 11, 12.
Bathurst A., H., and P. Association	W. G. Thompson..	,, 11, 12, 13.
Clarence (Grafton) P. and A. Society	T. Page	,, 18, 19.

Society.	Secretary.	Date.
Wellington P. and A. Association	R. Porter	April 18, 19.
Hunter River (West Maitland) A. and H. Association	W. C. Quinton ...	„ 18, 19, 20.
Dubbo P., A., and H. Association...	G. H. Taylor ...	„ 24, 25, 26.
Warialda P. and A. Association	W. B. Giddes ...	„ 25, 26.
Mudgee Agricultural Society	J. M. Cox ...	„ 26, 27.
Macleay (Kempsey) A. and H. Association ...	H. R. Gray ...	May 9, 10, 11.
Gwydir (Moree) P. and A. Association	J. G. Cohen ...	„ 9, 10.
Upper Hunter (Muswellbrook) A. and H. Association	Price Healey ...	„ 16, 17.
Upper Manning (Wingham) A. and H. Society...	J. J. Herkes ...	„ 16, 17, 18.
Hornsby, Thornleigh, Pennant Hills, &c., H. Association	H. Epthorp ...	„ 23, 24.
Cumnock P. and A. Association	W. Newmarch ...	„ 24.
Nyngan P. and A. Association	E. H. Prince ...	June 20, 21.
Warren P. Association	F. C. Thompson ...	„ 7, 8.
Cobar P. and A. Association	A. Roxburgh ...	„ 13, 14.
Deniliquin P. and A. Society	H. J. Wooldridge	July 19, 20.
Rivèrina (Jerilderie) P. and A. Society	J. Fulton	„ 24, 25.
Hay P. and A. Association...	F. W. Blanche ...	„ 26, 27.
Narandera P. and A. Association	J. F. Willans ...	Aug. 2, 3.
Forbes P., A., and H. Association...	W. G. Dowling ...	„ 9, 10.
Northern (Singleton) Agricultural Association ...	C. Poppenhagen ...	„ 15, 16.
Parkes P., A., and H. Association	H. S. Harwood ...	„ 15, 16.
Grenfell P. and A. Association	G. Cousins ...	„ 16, 17.
Moama A. and P. Association	C. L. Blair ...	Sept. 4, 5.
Cowra P., A., and H. Association...	S. Wright... ...	„ 5, 6.
Murrumbidgee P. and A. Association (Wagga) ...	H. T. Davidson ...	„ 5, 6.
Burrowa P., A., and H. Association	J. F. Clifford ...	„ 13, 14.
Albury P. and A. Association	G. E. Mackay ...	„ 13, 14.

Secretaries of Societies are asked to forward dates of forthcoming Shows as soon as decided.

[3 plates.]